SCIENTIFIC AMERICAN

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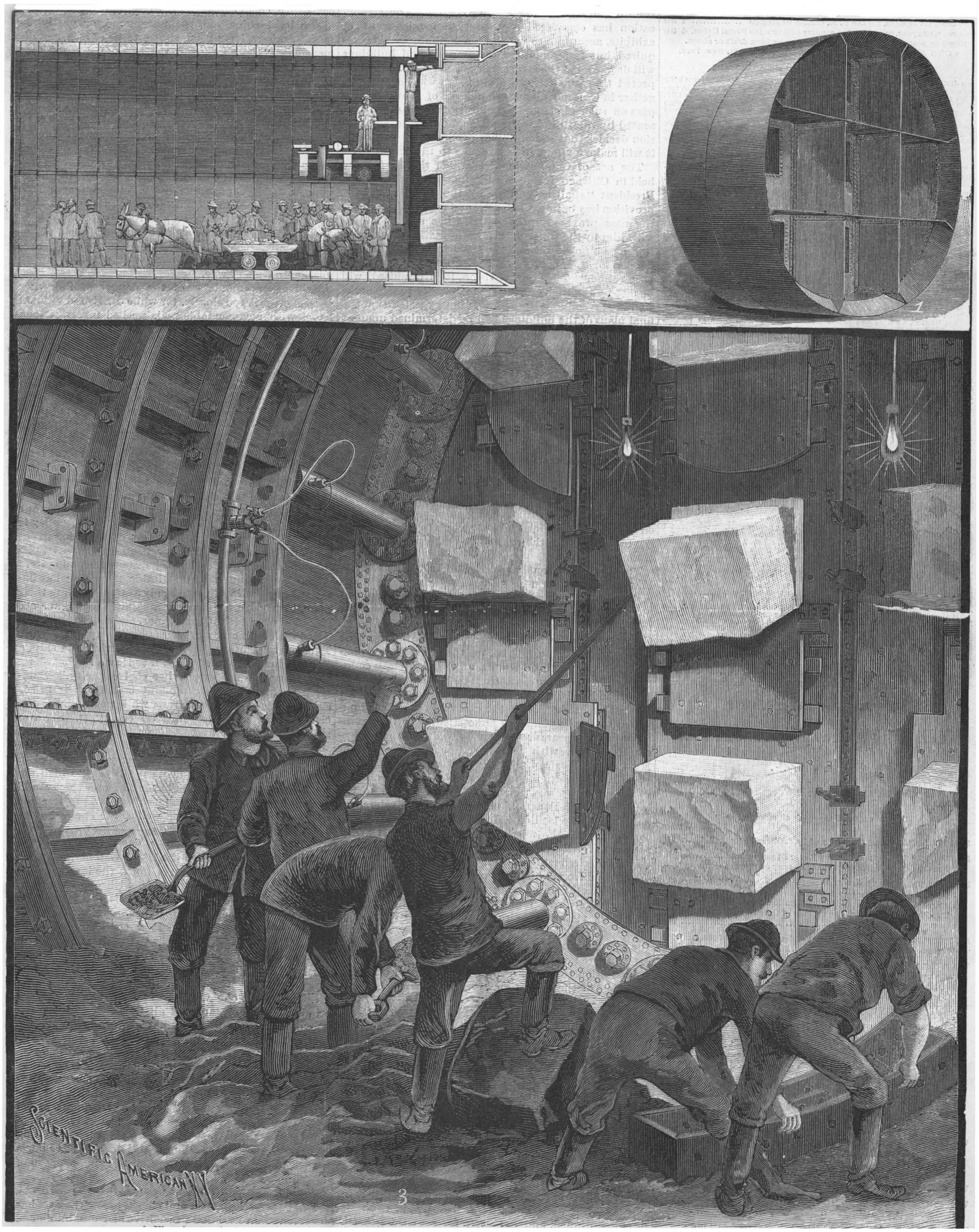

1. View showing the front or cutting edges of the shield. 2. Side sectional view of tunnel and hydraulic shield. 3. Interior view of hydraulic shield and tunnel.

THE GREAT RAILWAY TUNNEL UNDER THE HUDSON RIVER, BETWEEN NEW YORK AND JERSEY CITY.—[See page 279.]

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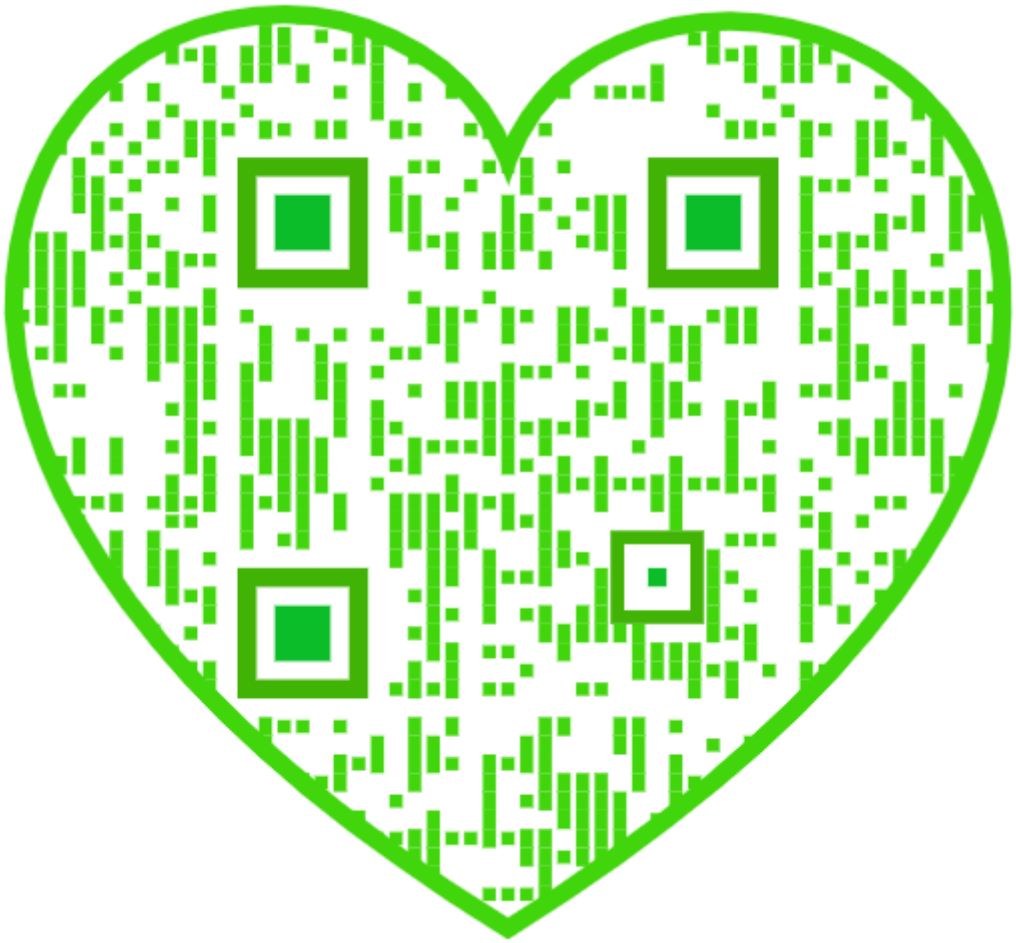

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PRACTICAL WORK FOR THE WORLD'S FAIR.

The executive branch of the management of the world's fair to take place in Chicago in 1893 is now practically complete, the site has been actually settled upon, and the broad work of preliminary preparation has been vigorously begun. The main site will be Jackson Park, with the Midway Plaisance connecting that park with Washington Park, and the Lake Front Park, giving an almost unlimited amount of space, easily accessible from every point. The building plans will be in a measure dependent upon the system of classification adopted, but engineers are now making careful surveys of the site as preliminary to the work of the architects. The committee on classification has completed a theoretical arrangement of exhibits, according to which nine buildings will be required, but the committee on grounds and buildings will decide as to the structures to be erected. It is expected that the national commission will be called together in Chicago about the middle of November to pass on such plans and specifications as may be presented by the Illinois corporation, and if the commission decides that the buildings proposed are adequate, it will make a report in accordance to the President.

The act of Congress under which the fair is to be held in Chicago is practically inoperative until the President "shall be notified by the commission that provision has been made for grounds and buildings for the uses provided for, and there has also been filed with him by the Chicago corporation satisfactory proof that a sum not less than $10,000,000 to be used and expended for the purposes of the exposition has in fact been raised." The first provision, it is promised, will be met by the time of the next meeting of the commission in November, although it is not expected that the final plans of the buildings will be determined upon at so early a date. The architects, however, will have enough data to enable them to provide structures giving sufficient space, and in about the shape needed, leaving details to be filled in afterward. As to the financial situation, it is stated that the directory has raised five million dollars by popular subscription, while the city of Chicago proposes to issue its bonds for an equal amount, and when the national commission thus reports, with a general outline of plans and specifications of the buildings, it is expected that the President will issue a proclamation setting forth the time at which the exposition will open and close. This will be communicated to the representatives of foreign nations, together with such regulations as may be adopted, and an official invitation given to each country to take part in the exposition and send representatives thereto.

The Committee on Foreign Affairs for the World's Fair has held several meetings in New York City to look over the ground and arrange for the most complete variety of exhibits that it will be possible to get together from foreign countries. Mr. William E. Curtiss, of the State Department, with the indorsement of Secretary Blaine, laid before the committee a plan for a collective exhibit from the Latin-American countries, to include representations of life at the court of Ferdinand and Isabella at the time of Columbus, with an exact reproduction of the caravel in which Columbus sailed, to be placed on Lake Michigan; the equipment and appearance of the expedition under Hernando Cortez, with representations of the city of Mexico and Mexican life under Montezuma; similar presentations as to life in Peru under its Incas, and exhibits showing what has been discovered as to the buried cities of Yucatan, in connection with the present state of the leading industries in all the countries south of us in the western hemisphere. Mr. Curtiss' plan calls for the employment of many agents to obtain the desired material, but it covers only a portion of the field from which it is understood the committee intend to seek interesting exhibits by means of the work of its direct representatives, as appointments with this view have already been made for Japan, China, Egypt, Turkey, and other countries. Although the commencement of the work has been so long delayed, there now seems to be apparent on every hand a disposition to do everything possible to assure the greatness of the exhibition.

DEFECTIVE NAVAL DESIGNING AND MATERIAL.

From the recent tests of armor plate at Annapolis it would appear that British practice in war ship building is more expeditious than certain, their compound armor plate having been fairly demolished by a gun play that the French nickel-steel plate withstood, and even the Creusot steel plate did not altogether succumb to. This is the material with which the newest and most powerful of Britain's ships are belted; still more of it having been ordered for the eight costly 14,150 ton battle ships now building. Why was not its insufficiency long since discovered? or, being so discovered—for it is hard to believe that such skillful gun makers, such cunning metal workers as the English were not informed—why was not its use discontinued, and a search for something better instituted? Perhaps red tape and the circumlocution office—always formidable obstacles in the way of reform—interposed; perhaps it was official negligence or something worse. In any case there is a lesson for us which should not go unheeded.

Armor plating is by no means the only department of British war ship building which has given proof of demoralization. Overweighted ships, unstable batteries, cumbersome and uncertain machinery, these, too, have resulted from much of the designing, and we do but quote the British critic in saying that such errors of construction have rendered an important part of the British fleet fairly impotent, the larger craft, as is demonstrated at each succeeding practice maneuver, exhibiting large capacity for consuming coals with small capacity for carrying them.

The light ships, too, the unarmored or partly armored cruisers, have been shown to be of incorrect dimensions, "too short and too broad for speed," we quote an English naval authority, "and lacking in coal capacity, too deeply immersed for safety and comfort of crews."

We had proof of this recently, in the case of our own Baltimore, for the designs of which a former Secretary of the Navy paid the British a large sum of money. The Baltimore recently averaged seven knots an hour, not much more than half the speed of a quick-heeled sailing craft with a fair wind, on a voyage to Stockholm, Sweden; and, while one apologist may allege that she had orders to go "slow," and another that this snail-like pace was owing to foul bottom and lack of sheathing, it may be averred without the fear of contradiction that she has not done anything since her trial trip to indicate a capability to fulfill her mission in time of war.

Evidence accumulates of the danger of following British criteria too closely, for while British designers have, with commendable zeal, pushed investigations in various directions and followed promising theories to their conclusion, they would seem not yet to have hit upon a design for a battle ship which so far as has been publicly demonstrated possesses all the elements necessary to effectiveness, to wit: buoyancy, coal capacity, invulnerability, steadiness.

We have their own word for this, with a deal of practical demonstration to sustain the assertion. The latest British authority to speak on the subject, Admiral Sir Thomas Symonds, has been incited by the recent tests of armor plates at Annapolis to send a circular letter to the English press summing up the present condition of British war ship designing and furnishing. He says: "Whether we regard our guns, our ships or our armor, the same lack of a wise and definite policy is evident. Our guns are admitted to be lacking in endurance, our compound armor has been proved to be incomparable with French nickel-steel, the bad system of our heavy guns and unsuitable mounting has immersed our battle ships so deeply as to necessitate their central body—in which the large quick-firing guns are placed—being left without armor, and consequently exposed with their crews to being swept away by shell fire. This overweighting, besides endangering the ship, a ship originally designed with far too low a freeboard, reduces to an absurd extent her coal capacity." Summing up, the British complaint is that their heavy ships menace their own crews while not having sufficient coal capacity to reach an enemy, their lighter ships having armor that won't protect, and speed that won't overtake.

As to our own navy, we have, as yet, succeeded in building a fleet of "commerce destroyers" which are not fast enough to overhaul the commerce they would destroy. Will the big battle ships now projected be able to resist the elements as well as the enemy?

New Steamer for the Coast Trade.

There was launched on the 1st of October, from the shipyard of William Cramp & Sons, the largest vessel ever built in the United States, with one exception. This vessel is named El Sol, and is owned by the Pacific Improvement Company and intended for service between New York and New Orleans. She is 400 feet long, 48 feet beam, and 33¾ feet deep, and has a tonnage of 4,300. She will be run as a freight boat exclusively, no accommodations being provided for passengers.

She is fitted out with steam steering gear, steam windlass and capstan, and all the other modern improvements incident to a first class freight steamer. She will carry four steel masts and be schooner rigged. The vessel will be supplied with triple expansion surface condensing engines, with high pressure cylinders 32 inches in diameter, intermediate 52 inches, and low pressure 84 inches, with 54 inch stroke, with a working pressure of 160 pounds. She has three double ended cylindrical steel boilers, each 13 feet 10 inches in diameter and 20 feet 6 inches long, each weighing about 58 tons. The machinery will develop 3,500 horse power, and the vessel is expected to attain a speed of 14½ knots an hour.

BLACKENING the nose and cheeks under the eyes has been found an effectual preventive of snow blindness, or the injurious effect of the glare from illuminated snow upon eyes unaccustomed to it.

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THE EUCALYPTUS.

BY NICOLAS PIKE.

As we have all climates in our great country, and means and ability to utilize them, it behooves us to introduce from every quarter of the globe products that may eventually benefit us; especially anything that can assist us in the great problem of purifying our atmosphere, in view of the vast hordes flocking to our shores. We have extensive tracts, now in their primitive barren wastes or swamps, that will very soon have to be reclaimed for occupation. Therefore, I wish to speak of trees, of course generally known by name, but not familiar to the public at large for their valuable properties. They could be imported and planted by thousands, to advantage in the near future, not only as a sanitary measure, but for industrial and commercial profit also.

To digress for a moment from my subject, I would call attention to the progress made in the last half century by scientific research in every branch of every profession. Especially is a change noticeable in medicine and surgery. In the latter, so marvelous have been the discoveries, and such delicate operations are daily performed with almost miraculous skill, that it really seems as if very soon there would be few ills the body is liable to that the surgeon's knife cannot reach.

In medicine, too, how the developments of Hahnemann's theories have proved we can get well without being dosed, and bled, and blistered in a way that no respectable owner would treat a horse or dog nowadays. In physic, however, there is much to be learned, and peculiarly is this true in regard to malarial troubles. There are plenty of theories and so-called remedies, but as in many other diseases, *effects* are only too often ministered to, and the *cause* ignored, yet few ills in the aggregate give more suffering than malaria.

In most diseases fever acts a prominent part, and if careful statistics could be made of the actual exciting cause, no matter what form the effects take, in more than half malaria would be found; perhaps inhaled from sewers, foul odors and gases, marshes, etc., but still in the blood. Surely then any remedy that could purify our surroundings should be heartily welcomed.

To return to the subject of this article, I believe that in the trees of the eucalyptus family a relief may be found for the malaria so prevalent in some parts of every State in the Union. Australia is the principal home of the eucalyptus, where it forms 90 per cent of the forest trees. All have gummy secretions, and from the varied tints of the foliage go by the local names of blue, red or white gum trees. From the peculiar bark of many they are also called "stringy bark trees." To us moderns, our knowledge of them only extends to the discovery of New Holland, the former name of the great fifth continent, but geologists give them a very respectable antiquity, as they are said to have had representatives in early Eocene times.

Nearly all the eucalypti grow very tall, some of them rivaling our giant *Sequoia Wellingtonia* in height. An English naturalist measured one 400 ft. high, and four men on horseback could stand in a cavity of the trunk. One of the *E. amygdolina* that had fallen in a mountain gorge was 420 ft. long, with circumference in proportion, and some in the Yarra district are over 500 ft.

There are more than one hundred specimens of eucalyptus, but I will only mention a few of the most important and useful. Very many have long attracted notice from their valuable properties, and they ought to be better known here. Their flowers are apetalous, but have masses of stamens like the myrtle. The bud has an operculate calyx, formed by several jointed leaves, united throughout, and separating at the articulation in the shape of a lid which flies off when the flower expands.

The *E. oleosa* or *piperita* has the smell and qualities of the famous *cajeputi* (*Melaleuca minor*), so well known in India for the cure of rheumatic affections. The wood is extensively used for fuel and the bark for paper making. It does not grow to the great height of some species, but covers large tracts of ground, the roots running horizontally over the surface.

From the *E. mannifera* exudes in the dry season a saccharine, mucous substance resembling manna in action and appearance, but less nauseous. *E. gunnii* furnishes a copious supply of a cool, refreshing, slightly aperient liquid, which ferments and acquires the properties of beer. The giant eucalyptus is sought for its beautifully veined wood, and is called the mahogany of Australia. The *E. resinifera* has pendent branches resembling a willow. The bark is very thick, and is taken off in sheets as a covering for the houses of the natives, and it yields also a kind of gum kino sold in the medicine bazars of India from its use in diarrhea.

From the last two mentioned an abundant juice flows of a red color, containing considerable gum and tannin, and a single tree will often yield 60 gallons. All the above are valuable, but none to such an extent as the *E. globulus*.

It has strong roots and smooth bark, and the bluish leaves give it the name of blue gum tree. Every part of it exhales a powerful, balsamic odor, and the leaves and seeds when crushed smell like tobacco. Bees are strongly attracted to this tree, and nests yielding abundant honey are often found in it. The wood is very hard and heavy and greatly used for building and naval purposes. It is of a fine red color, and very durable, as neither air nor water acts on it, and insects do not attack it. It is especially sought for in the construction of railways.

Many species of eucalyptus have the properties of cinchona in their leaves and bark, but none equal to the *globulus*, which has them more abundantly than the Brazilian tree. Van Vauquelin obtained by analysis an essential oil containing eucalyptal camphor closely resembling the resin of cinchona. This extract yielded a substance capable of neutralizing the strongest acids, and forming crystalline salts. The sulphate crystallizes in star-shaped crystals like sulphate of quinine or cinchona. The narrow leaves of the tree are principally used, dried and powdered, and strong tinctures are made from them. The bark also produces favorable results. So efficacious are preparations from this tree in marsh and other fevers that it is known as "the fever tree." The medicine has a warm, aromatic, bitter taste, and is invaluable in exciting the flow of saliva. It lowers arterial tension, and is useful in hysteria, cerebral anemia, etc. When the leaves are smoked, they relieve asthma, bronchitis and whooping cough, and have also been employed instead of lint for wounds.

When properly administered, it will certainly eradicate all poisonous matter from the system, and cure malarial fevers, where quinine utterly fails to do more than temporarily arrest them. The preparations from the eucalyptus have a great advantage over those of quinine. When excessive or constant doses of the latter are taken, they will often establish some local disease, and I am not surprised at seeing so many sufferers from malaria when I think of the quantities swallowed. In some malarial districts I have seen quinine pills taken with every meal for weeks together. The alimentary canal becomes disordered, nausea and constipation ensue, and a febrile state is set up, with excitement of the whole vascular system. The cerebral and spinal organs become deranged, throbbing headaches and giddiness often occur, sight and hearing are weakened, and the spleen sensibly affected. The joints, especially the wrists and ankles, suffer, and when diarrhea or dysentery follows, it is very difficult to cure. In fact, unless administered by a skillful physician, quinine is a dangerous drug, and I have known many fatal cases from its misuse.

Now, the eucalyptus has almost the reverse effect of all this; has none of the ringing of the ears and troubles caused by quinine, and prevents all stomach complications. A well known Brooklyn doctor assured me it was the finest medicine known for that terrible Bright's disease, and I feel sure, if fresh powder could be procured, it would be of incalculable benefit to the victims of malaria. I think I have said enough of its varied uses, and will now show the good it has done elsewhere, and there is no reason why we could not have all the benefits to be derived from it in our own country.

Up to 1870 one of the most fever-stricken countries of the world was the Maremma, the Roman Campagna, where the neglect of ages had allowed stagnant marshes to form in what was once a well populated, healthy district, till it could only be inhabited a small part of the year. At that time large plantations of the eucalyptus were made, and the Trappists have a large establishment there where they live all the year round, fever being almost eradicated. They use the wood for their buildings, and say it is the best and strongest they can procure. In Nice, Mentone, Corsica, the South of France, Egypt, Sierra Leone, Natal, Tahiti, etc., where they have been extensively planted, fevers are fast disappearing. Over a million trees have been planted in Algeria, and their sanitary influence has been most marked. Wherever they have been planted in compact masses, there intermittent fevers are greatly diminished and much marshy land reclaimed. They have been very largely cultivated in some districts in India, and the inspector of forests writes that, irrespective of their salubrity, the wood is very valuable, and at ten years old a tree is worth £20. In California the eucalyptus has been planted with the object of lessening droughts along the line of the Central Pacific Railway.

All these places were more or less deadly from the miasma engendered by festering marshes and other causes. Now life is not only bearable, but enjoyable, from a very simple source—the taking advantage of one of nature's own cures. By planting these trees in numbers their roots have drained the soil, and by some elaborate process have absorbed the contagious effluvia, and the leaves give out the balsamic odors so healthful to breathe.

The peculiar region of these trees is the temperate part of Australia and Van Dieman's Land. They thrive in a mean temperature of 59° to 72°, but I think they will grow in 45° to 50°. Of course this prevents them becoming hardy denizens of our Northern States. They will, however, suit admirably our Southern ones, especially in sandy soils near the sea. They grow easily from seed, and are of very rapid growth, and if the various kinds are planted out unsparingly, they might become large factors in the new industries that would spring from their cultivation, and our vast waste marsh lands would be utilized as well as rendered salubrious for occupation.

Though our northern climate forbids this culture out of doors, there are plenty of ways and means by which the eucalyptus can be made available even here. First of all, I would say a word to the florists so widely spread over our country now. The peculiar conditions of temperature, etc., of their hot and green houses render all who work in them very liable to malaria. To them it would be an easy matter to grow a plant in every house which could be checked back to keep it within bounds, and the sanitary state of their premises would soon change. It would be well to sow the seeds of the *E. globulus* largely for distribution. Every railway depot, hotel, or any other building where many people congregate could use this plant advantageously. Especially is it advisable, as persons are constantly coming and going, who are filled with malarial and other germs from various infected localities. The powerful germ-destroying odor of the plant would kill any floating in the atmosphere and help the sufferers too.

There are few schools that cannot spare a window on each floor for a plant in the winter months to be put out in a tub, in summer in the playground. Every hospital has wide, windowed corridors, and it would pay to have a well kept eucalyptus in each one. Even mansions that can boast of spacious staircases and halls might spare a niche for a blue gum, as it can be constantly checked in its too liberal growth. It can be put out as a handsome ornament to the grounds in summer, and new ones reared for the house every year.

The seeds are very easily raised, but it would be better to procure plants about a foot high from the florist. The rapid growth of this tree is something abnormal in vegetable life. I planted some once, and although I headed them well back when three or four feet high, in one year they were above the roof of a one story house. Of course not here in the North. I have grown all three of the gums, blue, red, and white, and when young they are very pretty, especially the red gum. The plants must be constantly nipped back to make them strong and stocky, and be grown in good soil with considerable sand in it, and kept well watered. The whole plant gives out the peculiar odor, but it is not unpleasant.

I trust my suggestions may be taken up in various quarters, and that I may live to see the eucalyptus flourishing everywhere it is possible for it to thrive in this country.

A Successful Wrecking Job.

The Magnetic was sunk last May in forty feet of water, four miles above the entrance to the canal. The Continental, which was in tow of the Magnetic, caught fire in the wheel house, her steering gear got out of order, her signal cords were burned, and before she could be got under control, struck the Magnetic amidships and caused her to go down. James Murphy & Co., of Port Huron, took the contract of raising the sunken vessel. They commenced the task about two months ago. The means adopted in the work were novel and most successful, and mark a new era in the wrecking history of the lakes. Six pontoons were placed under the stern of the vessel and her bilges were loaded down. She was made as near airtight as possible, and pumps were placed in position. When everything was ready, the pumps were started, and as fast as the water was drawn out air was forced in, in order to keep her from collapsing. After working in this manner for a while, her stern gradually rose until it was forty feet in the air. Then a tug on either end slowly towed her to the shore as the water was pumped out. She now lies on the bottom in fifteen feet of water. She was pumped entirely dry, and was then found to be leaking slightly. She is but little damaged, except where she was struck by her consort, and this injury, it is thought, can be fixed at a cost not exceeding $1,000. She was loaded with 1,950 tons of ore, which has not been disturbed. She will be towed to Cleveland with the ore in a few days. This is the first feat of the kind ever attempted, and Captain James Murphy, who was personally in charge, deserves great credit for the skillful completion of the undertaking.—*Marine Record.*

Electrical Insulation.

Mr. A. C. Robbins says: There is great need of improvements in insulating material. An insulation for wires is needed that will be cheap, light, flexible, and durable; one that dampness will not decay, nor the heat of an electric arc dissolve or burn. A fire-extinguishing liquid is also to be desired which will be a non-conductor of electricity. When these have been obtained, and not until then, can the large telegraph offices be absolutely assured of protection from fire. The one who succeeds in obtaining these results will, I am sure, be richly rewarded for his trouble.

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Cracked Ice for Invalids.

One more thing there is that nurses apparently do not know, and that is the value of cracked ice in cases where a prolonged drink of any fluid is next to an impossibility. Finely cracked ice, administered in a teaspoonful of champagne or brandy, has been the rallying point for many a sinking patient. Or the ice alone, finely crushed so that it simply melts away in the mouth, trickling down the throat rather than being swallowed as a draught, is a most useful stimulant. The writer in the Philadelphia *Ledger* will never forget the look of amazement in Alice Fisher's face when she was shown the ice-shaving machine at the Pennsylvania Hospital soon after her arrival there, and when an informal visit to that good old hospital gave an opportunity for conference over many points in nursing.

That ice should ever be needed in such quantities and portions as to require a machine for shaving it was indeed a novelty to her. In common with her countrymen generally she had the true English horror of ice water, but the use of ice itself is a quite different matter from deluging the stomach with a cold fluid. The melted ice is not of the ice water temperature when it is swallowed. People who take cracked ice get the stimulus of ice upon the nerves of the mouth and tongue, and not the flooding by water of the feeble throat and stomach. Did not one ingenious nurse, at the time a matron, in the University Hospital, some years ago, actually feed a patient, who revolted at the mere thought of food and was starving in his exhaustion, by deftly sprinkling pounded ice over the bits of broiled chicken liver that she had prepared to tempt his taste?

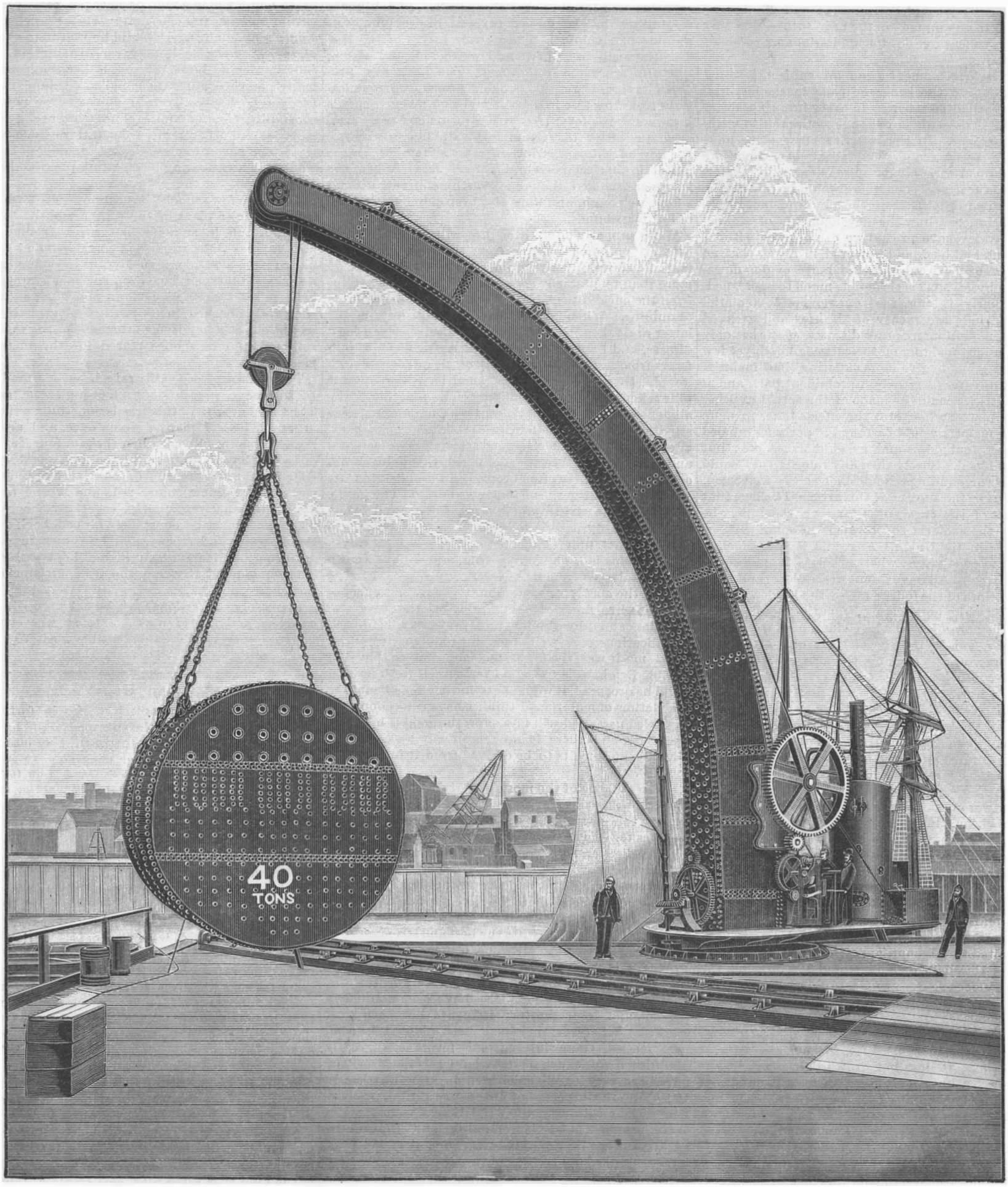
It was the novelty and the sparkling ice that carried the day. The man tasted, enjoyed, and ate it all. Each country adds its contribution—according to climate and physical peculiarities—to the science of nursing. It has been said that no one in England can imagine the depths of weakness into which American patients may suddenly go and may be pulled up and out of, because the English climate is not so exhausting in its demands. The uses of cracked ice in cholera cases are familiar to some. It is possible that with hot water bags at the feet, hot mush poultices on the stomach, and a constant diet of cracked ice, no further treatment might be needed to complete a cure. Nursing skill counts for much, and every woman should have as much knowledge of it as will be sufficient to keep patients from sliding down hill until the proper officials arrive.

A FORTY-TON WHARF CRANE.

We give engravings of a wharf crane recently erected at Messrs. William Allen & Co.'s works, Sunderland, used chiefly for lifting marine engines and boilers in or out of ships. We are indebted to *Engineering* for our illustrations and the following particulars:

The foundations, mainly of concrete, are 22 ft. square on plan, and about 30 ft. deep from the surface of the wharf. Nearly 350 tons of material were used in their formation. In this mass there is a central well lined with cast iron, the lower bed plate, with a socket for the crane footstep, forming the bottom of this well at about 21 ft. from the level of the wharf.

The jib is of hollow box section, made entirely of best mild steel plates and angles, tapering from the footstep upward to the wharf level, where it attains its maximum section, and gradually tapering away again to the upper end, where the lifting sheaves are placed. The load swings in a radius of 33 ft. 6 in., and the lifting hook can rise 40 ft. clear of wharf. The crane is nominally for thirty tons, and with this load suspended the greatest tensile stress on the jib is 4·39 tons per square inch of material in the section, and the greatest compressive stress 3·09 tons. When officially



IMPROVED FORTY-TON WHARF CRANE

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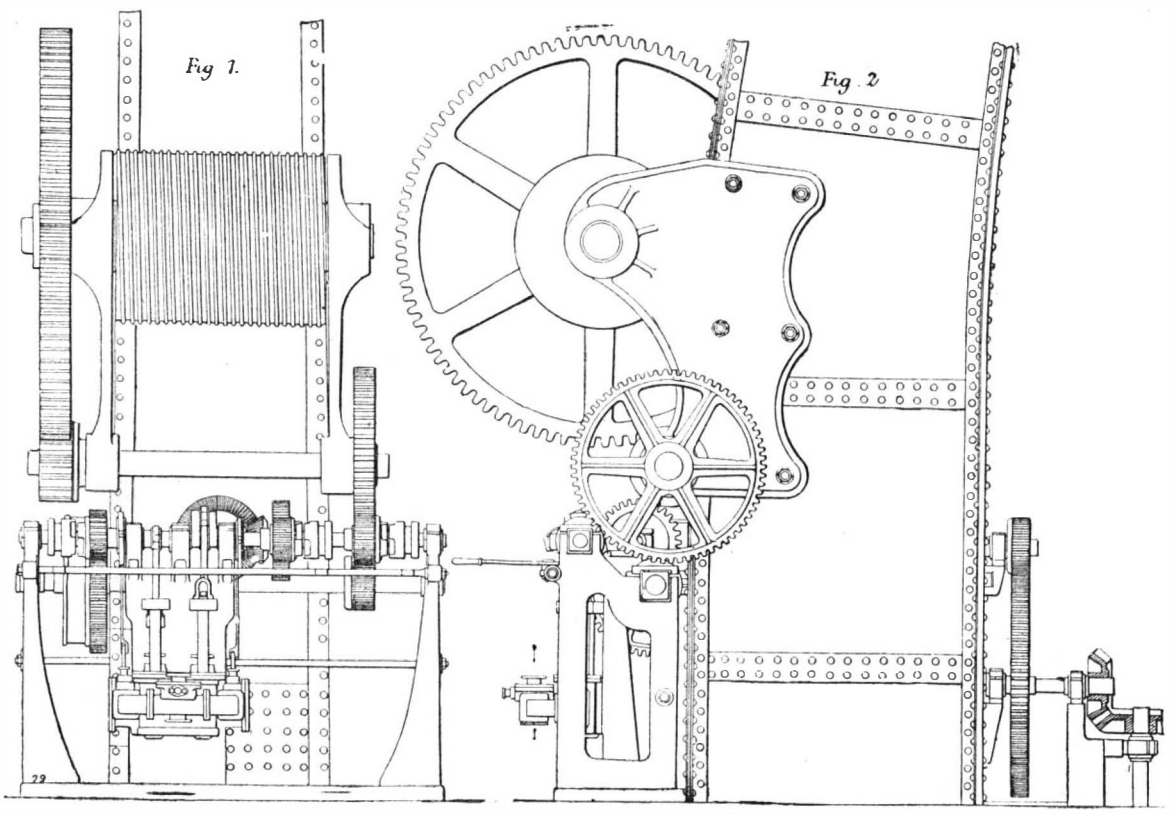
tested a load of forty tons was used, and this was raised, lowered, and slewed with the greatest of ease. The steel wire rope is made up of six strands, each containing thirty-seven wires, the diameter of the rope being 1⅜ in. and the calculated breaking stress 54 tons. In actual use the stress on the rope is only one-fourth of the load being lifted.

The engine cylinders, the position of which is shown in Fig. 1, are 7 in. bore and 10 in. stroke. Spence's patent reversing motion is used. When the crankshaft runs at 200 revolutions per minute, loads up to 7 tons can be raised at a speed of 13 ft. per minute, and heavier loads at 4 ft. per minute. The brake has full control of the heaviest loads, and can be worked either by hand lever or screw. The latter enables the attendant to keep the load suspended for any length of time, without interfering with the engines working for slewing.

The slewing is effected, as shown in Fig. 2, by a train of gearing from the crankshaft, and a pinion on a vertical shaft working into the circular rack fixed on the foundations at the level of the wharf. The makers of the crane are Messrs. Davis & Primrose, Leith, Edinburgh.



IMPROVED FORTY-TON WHARF CRANE.

A New Plan for Greenland Exploration.

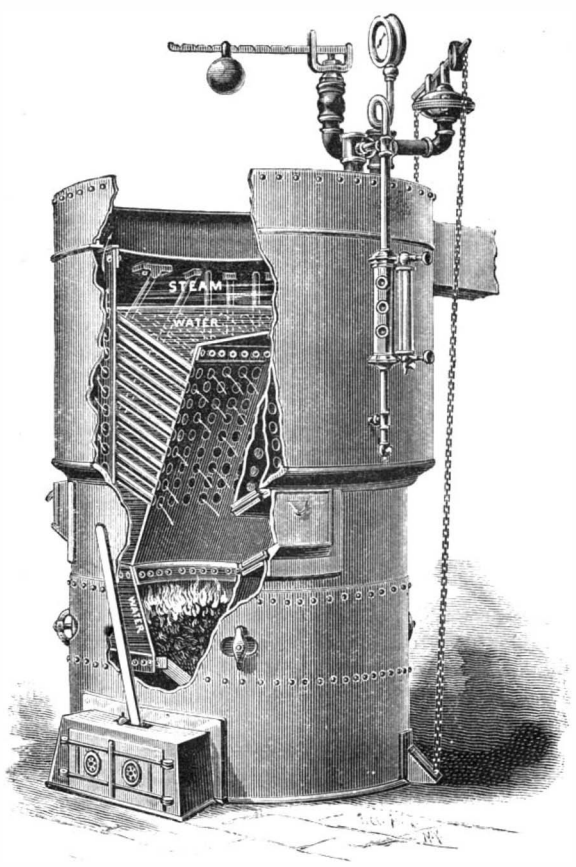
Lieut. R. E. Peary, of the United States Navy, has a plan for completing the survey of Greenland that is different from any undertaken before, and he firmly believes in its feasibility, as he had the initiatory experience of a two hundred mile walk over the ice cap of that far, mysterious land four years ago. The scheme he proposes is to sail as far up the west coast of Greenland as possible in a ship, and start thence on foot, walking near the edge of the ice cap until he reaches the farthest point north. Thence he can go down the eastern coast—if supplies and enthusiasm hold out—until he reaches Cape Bismarck, which stands at the northmost limit of exploration on that side, as Cape Washington does on the other. From that point he can cut westward across the continent, as Nansen did recently, and reach his starting place, where his ship would be waiting. The whole of Greenland, except a strip of a few miles along the coast, is covered with ice, not a mere sheet, such as we find on high peaks or on the ground in winter, but an enormous bulk a thousand feet thick, under which elevations greater than those of the White Mountains are entirely buried. The glaciers that push from its edge descend to the sea through gaps in the bordering mountains, and the tides detach from their front the icebergs that come south in the Arctic current. The edge of this ice cap is cracked and seamed with dangerous crevasses, like those in the Alpine and American glaciers, but on the higher ice, just within this edge, it is as firm as marble and stretches to the horizon, a white prairie, dazzling in full day and reflecting rose, pink, violet and orange when the sun is low at night. There are occasional hollows filled with drifts and slush, but these Lieutenant Peary crossed on snow shoes on his former journey, while for a part of the distance he wore Norwegian skees—long, wooden ice shoes. His provisions he and his companion bore on a light, strong sledge that also served to carry them down slopes with the speed of a toboggan and that went briskly before the wind on level surfaces, with the aid of a small sail. So equipped this courageous explorer would undertake a survey of northern Greenland. It is easy and perhaps natural to decry such experiments as Lieutenant Peary hopes to undertake, on the score of inutility, but results are better than forecast as a criterion of usefulness. It is an age of truth seeking and of some truth getting, and no fact, however remote it may appear from daily experience, or how trivial in its human relations, is valueless. The restless activity of nineteenth century explorers is balked by nothing, and if this officer does not determine the coast line of northern Greenland, the risk and the honor may be assumed by a representative of some other nation. America, with Lieutenants Greely and Lockwood as its deputies, has "broken the record" thus far, and Lieutenant Peary wishes to complete it. The plan he proposes is not only cheaper, more direct and more feasible than that of his predecessors, but it is safer, and it exposes no large body of men to peril. His mapping of the coast line would appease the hunger for geographical knowledge that dictates the resolve of men to find what sort of world this is that we are cast upon, the observations that he would be enabled to make of atmospheric, electrical, and ocean currents, of the behavior of ice at the glacier "toes," of the flora, fauna, and marine life of that region, of the geology and mineralogy of the shores, might prove to be of economic worth.—*Brooklyn Eagle.*

Sale of Horse Flesh in Paris.

Just twenty-four years ago the first horse butcher in Paris opened his shop. Since then there have been started nearly 140 horse flesh shops in the department of the Seine, and at the present time about 20,000 horses are killed every year in Paris for human food. In Paris the price of the meat is less than half that of ordinary butcher's meat. Berlin is following the example of Paris.

A STEAM OR HOT WATER HEATING BOILER.

The illustration represents a boiler of simple construction which can be used for high or low pressure steam, or as a hot water boiler for heating buildings, etc. It has been patented by Mr. Joseph Bromich, of Topeka, Kansas. The fire-box and combustion chamber are made in two parts, as two cones, fitted together at their bases, and are entirely surrounded by the boiler proper. From the upper part of the combustion chamber upwardly inclined tubes lead through the water space and the shell of the boiler into an annular space, formed by a shell secured to the outside of the boiler. This shell, forming the smoke space, is made in sections, to be conveniently removed to enable the operator to clean the flues when necessary, and the top of this space is covered by a ring with a series of elongated openings communicating with the interior of a bonnet on top of the boiler. The apertures in the ring increase in size with their distance from the smoke flue, in order to equalize the draught. From one side of the bonnet leads the smoke flue, provided with the usual damper automatically operated by the damper-regulating device. The feed channels from the furnace doors pass through the water space, and are downwardly inclined, for the ready introduction of the fuel above the grate bars, and hand holes are arranged near the bottom of the boiler to facilitate the removal of any sediment which may be deposited there.



BROMICH'S IMPROVED BOILER.

Testing Qualities in Paper.

The absolute strength of paper is measured by its resistance to tearing. In machine-made paper the strength and stretching power vary according as the force acts lengthwise or across; in hand-made paper there is little difference. In the former the difference is in the proportion of 2 : 3, according to the direction of the tearing force. The stretching power acts inversely to the strength, *i. e.*, is greater across than lengthwise.

In order to test the resistance of paper to the most varied mechanical wear, it is crumpled and kneaded between the hands. After such treatment a weak paper will be full of holes, a strong paper will assume a leathery texture. The test also gives a rough insight into the composition of a paper, much dust showing the presence of earthy impurities, while breaking up of paper shows overbleaching.

The thickness of a paper is ascertained either by measuring the thickness of a certain number of sheets, or by taking that of a single sheet by means of a micrometer, where the paper is placed between two rules, one fixed and the other movable, acting as a pointer showing the thickness of the paper on a dial.

Over three per cent of ash shows the presence of clay, kaolin, heavy spar, gypsum, etc.

Microscopical investigation of paper aims at determining the kind and quality of paper. For this a magnifying power of 150 to 300 diameters suffices, when, by coloring the paper with a solution of iodine, a yellow coloration shows the presence of wood fiber, a brown coloration that of linen, cotton, or flax, and no coloration that of cellulose.

The determination of the kind and quality of size may be made by boiling in distilled water and adding a concentrated solution of tannic acid, when a flocculent precipitate shows the presence of animal size; and by heating in absolute alcohol and adding distilled water, when a precipitate shows the presence of vegetable size.—*Paper Mill.*

Good Pavements are Cheapest.

Our city fathers might study very profitably a report by Consul Sherman, located at Liverpool, England, on the pavements, tramways, sewers, and artisans' dwellings of that city, published in the last number of "Consular Reports." The Corporation of Liverpool, he says, has adopted the policy of constructing its public works in the best possible manner, and in this way has succeeded in reducing the cost of maintenance to a minimum. Since 1872 only impervious pavements have been laid, and Liverpool has now 250 miles of the best paved streets in the world. The wisdom of this is not only seen in the reduced death rate, which has declined from 27·2 per thousand in 1880 to 20·3 in 1888, but in the reduced cost of maintenance of the streets. In 1879 the estimated expenditure of the cost of keeping 226 miles of streets in repair was $136,080; in 1889 the estimated expense for the same was only $40,824 for 250 miles of pavement. Permission, he says, is never given for private parties to cut through the pavement of any street for any purpose. When such work is necessary, the corporation will do it in its own thorough way, and the interested parties must pay the entire cost. All the street railway tracks are laid and owned and kept in repair by the city, and the company using them pays an annual rental of 10 per cent on their cost. Accompanying this report are the specifications under which the streets are paved and the sewers built, which show that most thorough work is required.

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Overlaying.

This is the problem in all press-rooms where speed is the great desideratum. Indeed, in our get-up-and-get era, speed is such a leading point that how to make ready in the shortest time may be said to be the one great question in all our press-rooms. Many conflicting theories have found advocates. "Paste as you go" is the one that has been most generally adopted, where the very highest class of work was not called for. Wherever the high grade, or art finish, was wanted, resort has been always had to what is known as the "overlay" system; in other words, to the plan of making special overlays apart from the form and sheet, and pasting them in place on the printed tympan sheet.

While the special overlay system has always won the prize for fine work on cuts, etc., yet, with the vast increase of cut work in our day, and the prospect of still greater volume, the time spent in overlaying cuts becomes a very serious item of expense, and eyes and brains are cast about to find a speedier system that will produce as good results.

Many years ago, a very clever French Canadian—a genuine artist in his way—stumbled upon a method of using a thin, gummy paste in such a way as to represent the layers of paper that pressmen employ in making overlays. His recipe for preparing that paste was his own. With it, and his artistic taste in manipulating and spreading it, he produced wonderful results in an incredibly short time, distancing all his fellow workmen both in speed and quality. Efforts to obtain his secret failed. Even his feeder, who to some extent was in his confidence, and who is still working on presses in this city, does not know the composition of that paste. But it did its work, and well. After five, ten, fifteen, or twenty thousand impressions, it remained the same elastic yet firm coating that had been put on with brush or finger as the case might be; and the impressions taken were as fine and delicate as the most labored overlay worked out with paper.

Innumerable experiments have been made in this country to imitate the high results in finish and time which our friend, the "Canuck," accomplished, but thus far they have been measurably unsuccessful. The nearest to winning has been a preparation, or paint, in which liquid rubber or caoutchouc was a prominent ingredient. But even this, fine, delicate, and elastic as it was, left something to be desired, and thus failed to match the exquisite effects of the paper overlays; although on ordinary work it was a surprising time-saver, as, being put on with a brush wherever needed, it could be applied in any thickness or in as many layers as were required, saving most of the time spent in the innumerable cut-outs and layer on layer of pastings of the other method.

The "paint" idea has gone across the ocean and found recent adopters in Great Britain. Critical examination of cut-work that comes to us from there, and which was produced by the paint method (though without the caoutchouc ingredient, we are certain), convinces us that they are behind us, even in this. There is an immature, unfinished look about their cuts that shows the pressmen were in too great a hurry, or their "paint" was too coarse or too soft for its work; or else the pressman had not an artistic sense of the true values in the pictures.

There is little doubt that, with the enormous increase that is coming in fine illustrated work, the old method of overlaying with pasted paper will have to go, and be displaced by some method that will combine speed with finish. The "paint" *principle* looks like the thing; but the true ingredients have not yet been found. Besides, for the very highest work, it will require a genuine artist to apply it. Here is a field for study and experiment open to the pushing young pressmen of America. Those who get first on the ground will pick up the gold. It is a fair field for discovery.—*American Art Printer.*

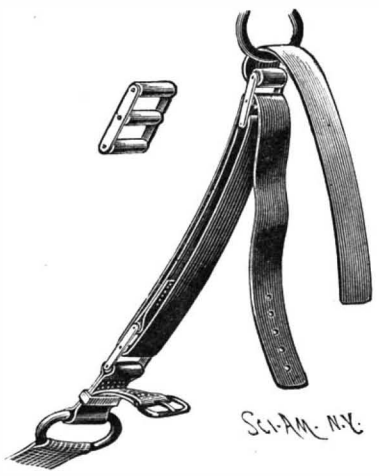
The Long Distance Telephone.

Ithaca and New Haven are now connected, and Mr. A. S. Hibbard has in mind a novel test exhibit for this winter. He will try to have the Cornell and Yale glee clubs give simultaneous concerts in Ithaca and New Haven. The two concert halls will be connected by telephone, and then the Yale club will sing, and both the Ithaca and New Haven audiences will hear the music simultaneously. Then the Cornell club will sing in Ithaca, and the New Haven audience will hear it as well as the one 400 miles away when the singing is taking place. Spice would be added to the entertainment if a joint debate between the Yale and Cornell navies could be arranged on the Yale-Cornell boating difficulties.

Mr. Hibbard, at his home in Morristown, received reports by telephone from New London during the last Yale-Harvard race. For the benefit of his guests he rigged up a couple of tin shells, each with its eight oarsmen, and by changing the relative positions of the boats at each report he kept his friends in high excitement for twenty-three minutes. At the end of the race the cheers for Yale from the spectators on the banks of the Thames could be distinctly heard in Morristown.—*N. Y. Times.*

A CINCTURE ATTACHMENT FOR RIDING SADDLES.

The device shown in the engraving, which has been patented by Mr. Henry Hartmann, is designed to facilitate the ready attachment of a saddle to a horse, and its quick removal. A three-bar reefing loop, shown in the small view, is attached to the cinch ring of the belly girth by means of a strap, one end of which is secured to the lower bar of the loop, while its free end is passed through the ring and up through a suitable keeper or clasp, terminating in a buckle. A second three-bar reefing loop, similar to the first one, is removably attached, by means of a metal cincture, to a ring fixed in the saddle. One end of the reefing strap is secured to the upper bar of the lower reefing loop, and is thence passed over the lower bar of the upper reefing loop, and downwardly around the center bar of the lower loop, being again carried upward over the center bar of the upper loop, the strap having perforations near its end adapting it for engagement with the buckle on the end of the strap connected with the belly girth. The cincture secured to the upper bar of the upper reefing loop is preferably of malleable steel, and its free end is passed through the saddle ring and bent downwardly. It should be sufficiently thick to hold the parts securely, but capable of being easily bent, it being designed that, after the girth is once adjusted to the horse, it will not be necessary to use the reefing strap in attaching the saddle, this operation being effected by simply pushing the cincture through the saddle ring and bending it downwardly. This attachment may be applied on one or both sides of a saddle.

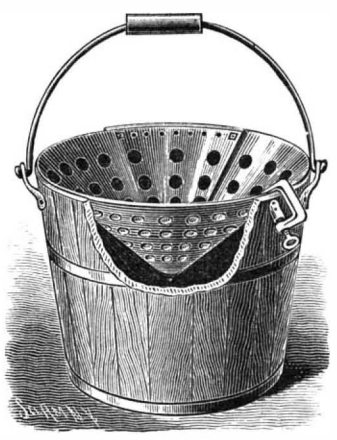


HARTMANN'S GIRTH ADJUSTER.

For further information relative to this invention address Messrs. J. P. and E. P. Mitchener, Stockton, Utah.

A SIMPLE FORM OF MOP WRINGER.

The illustration represents a device to be applied to a pail of any size to facilitate squeezing or forcing the water out of a mop. It has been patented by Mr. Alexander M. Borland, of Otisville, Orange County, N. Y. The device consists of a shell, preferably constructed of sheet metal and bent to the shape of an inverted cone, the ends of the metal sheet being made to overlap so that the size of the shell may be adapted to different sizes of receptacles, and being retained in such position by pins or short bolts and suitable nuts. The inverted cone is formed with an opening at the bottom, and has quite a number of circular apertures to permit water to pass freely into the pail. The inner end of the metal sheet forming the shell is made with a decided rib extending from top to bottom, this rib being adapted to engage with the mop when the latter is placed in the device and turned around, the rib also acting as a bearing against the pressure exerted in the act of wringing the mop. The device is secured to the pail by means of a simple clamp, as shown.



BORLAND'S MOP WRINGER.

Excavating in Quicksand.

At a recent meeting of the New England Waterworks Association, Mr. Albert F. Noyes read the following note: "Some years ago I had occasion to make an excavation in material known as quicksand, some 15 feet deep, near buildings. If the excavations were made in the ordinary way, a settlement of the foundations would be likely to occur, so I adopted the following method, which in my case proved successful; and I see no reason why, under similar conditions, and in a great many cases, it could not be used to advantage. The excavation, as I have said, was about 15 feet deep, and about 60 feet in length and 8 feet wide. Usually below these veins of quicksand there are veins of a coarse material which form ready conductors for the water, and the vertical distance through the quicksand is usually less than the horizontal distance; the ground water has the least resistance in the vertical direction, and tends to soften and take up the quicksand with it. If the water is drawn out, or the water level lowered below the bottom of the trench, this fine material becomes compact very much like clay, and the excavations can be made with perfect safety and the use of a light sheeting. In the case I refer to I used fourteen pipes 1½ inches in diameter, and these were driven equidistant about the excavation to be made, with the ordinary perforated well point, having attached outside a fine mesh brass screen. They were driven into a stratum of coarse material from 35 to 50 feet below the surface of the ground. The pipes were ganged together and attached to a common plunger pump, and the water was drawn down. I might state that the normal level of the ground water was within three or four feet of the surface of the ground, so we had to draw the ground water down some ten or eleven feet. We found by test tubes outside of the gang that we could readily hold the water to a level which insured the excavations being made without any difficulty whatever; in fact, the banks were dry, and the lower portion of the excavation was very firm. In one case the well points, after we used them, were sold to other parties at nearly the first cost. The pipes, which were taken from the pipe yard, were returned and used over again, so that there was little loss in that way; and the whole cost of driving the pipe was about $18, so that the expense of that method was really less than sinking a well outside of the excavation in the usual manner."—*Stone.*

Collotype Plate Making.*

I do not wish to trespass on your valuable time with a long paper, but to give plain instructions and formulæ, and show results, so that any of you interested in photo-mechanical printing can go home and try it for yourselves without being confused with unnecessary matter. The first thing is some good plate glass ground with emery, such as the piece here shown. It is very simple. I take two pieces and put a little emery moistened with water between them, and rub them round and round till I get as fine a grain as possible, and then well wash and clean with spirits and ammonia, when they are ready for the first coating, which is made as follows:

Sour ale or porter	30 ounces.
Silicate of soda	3 "

This is carefully filtered, and a little poured on the plate, and spread over with the palm of the hand; then put in a rack or stand on blotting paper to drain. No heat is necessary. They ought to be done over night ready for next day, when, after a good washing under the tap, at the same time rubbing with a soft sponge, and again dried, they are ready for the second coating, which I make as follows:

Coignet's gelatine	5 ounces.
Nelson's sheet gelatine	2 "

Soak in 80 ounces of water, then dissolve, and add bichromate of ammonia 2 ounces dissolved in 10 ounces of water to which has been added one-half ounce of liquid ammonia. The plates, which have been previously described, are carefully leveled in the drying oven, and the temperature raised to about 100°, when they are carefully coated with the second preparation just described, and dried at a temperature of 150°, when the gas or hot water is turned off, and they are allowed to cool gradually. They ought not to be used till next day, and they will keep good for about one week; after that time they become insoluble. The next operation is to expose under a reversed negative either wet or dry plates; but I have never seen a dry plate negative yet that can compare with a wet collodion one, although I have had nearly twenty-five years' experience. The exposure to light is difficult to describe. The best way is to use an actinometer, and give about the same time as you would for a silver print from the same negative; but a few trials will be of more service than a book full of instructions. After the plate is exposed sufficiently, take off the backing, and expose the back to light for five or ten minutes, according to the subject. This helps to bind the film to the glass, and prevents too much relief. The plate is now put into water, and allowed to soak till all the unaltered bichromate is washed out; then give a good rinse under the tap, well clean the back, and put away to dry spontaneously. They should not be used at once, but allowed to get thoroughly hard. The plate, after being put under the tap and dried with a cloth, is soaked with a mixture of glycerine 40 ounces, saltpeter 2 ounces, ammonia 7 ounces, for about five minutes, and dried again with a cloth, and is then ready for the printing, which can either be done in a hand press or by steam. The ink is very much like litho, and the machine the same.

I don't pretend to know anything new, but I have tried to show how collotype is worked, and the foregoing is exactly how it is worked every day by one of the largest firms in the world.—*Photo. News.*

* Read before the North Middlesex Photographic Club.

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Correspondence.

The Creeping of Belts.

To the Editor of the Scientific American:

I called the attention of our head engineer to the article "A Belt Problem," in your SCIENTIFIC AMERICAN of October 4, and he said at once:

"The lacing wasn't properly done. The outer belt was probably laced tighter than the inner, and as there was, of course, a greater strain on it the rivets were not strong enough to make up for the difference in tension, and pulled through. If the belts had been glued together and then riveted, there would have been no trouble." A. W. B.

[This does not settle the question of the disposition of belts to creep when doubled, although proper gluing and riveting does prevent it; for unless strongly held together in every part of their contact their nature is to creep by virtue of the pressure of the outer belt upon the inner one while in contact with the pulleys. All belts creep on the face of the pulley, caused by the compression of the inner side of the belt by bending over the curve of the pulley. With a siding belt not perfectly fastened to the inner belt, the same effect takes place with a pull equal to the stress upon the belt.—EDITOR.]

Filling Hot Stuff into Glass Jars or Bottles.

To the Editor of the Scientific American:

In reply to query No. 2435, J. B. Rosenberger, of St. Cloud, Minn., gives an undoubtedly good method for putting hot preserves into glass jars or bottles; but it has one drawback. It takes too much time to stop and rinse or even to empty the bottles of their cold water contents before filling, to say nothing of chilling the hot liquid by its contact with the cold vessel. In bottling anything while hot it is essential that its temperature be as little reduced as possible, and the cover or cork put in place as quickly as may be.

My plan of procedure is certainly much simpler and fully as effective. I take a kitchen towel or dishcloth, wet it thoroughly in water either hot or cold, fold it 4 or 6 ply, and stand my bottle to be filled on this pad thus formed. It is impossible to heat any liquid hot enough to crack or break a glass bottle or jar when this precaution is taken.

The bottles can be previously washed and drained dry, and when filled and immediately corked, will be ready to put away without any further attention. Ketchup put up in this manner will require no cording or wiring of corks, as it never works. Corks should be kept in hot water until used, thus rendering them soft, and closing the bottles in an airtight manner.

New York City. JENNIE BIEGER.

Natural History Notes.

Causes of the Ascent of Sap.—In the *Revue Generale des Sciences Pures et Appliquées*, Mr. A. Herbert criticises a memoir by Mr. Boehm on the causes of the ascent of sap, published in the proceedings of the Berlin Botanical Society. The causes of the ascent of sap in plants, says Mr. Herbert, is one of the most controverted questions that have been studied in recent times. Mr. Boehm, proceeding to the examination of this question by the method of elimination, discusses in succession the forces that cause the ascension of sap: (1) Osmotic pressure; (2) the difference of the pressure of the air inclosed in the dead elements of the wood; (3) capillarity.

The first cause he discards on account of the slowness of the phenomena of osmosis, and for the reason that a plant whose roots have been killed by boiling water does not dry, as would happen if the absorption of the water were due to osmosis.

Mr. Boehm, in a former theory, had indicated the difference of pressure of the air contained in the dead elements of the wood as a cause of the ascension of sap. He no longer regards such pressure as the principal motor of the liquid column, but he nevertheless considers it as a secondary cause that acts as follows: Suppose a cell containing water and an air bubble. If the latter drives the water to an upper cell, it will expand and the water contained in a cell below will compress it anew, and add to it also the air that it holds in solution. These differences of pressure therefore cause displacements of water, but they are much too slow to be the sole motor of the ascent of sap. The learned botanist maintains that capillarity is the most important cause of the ascent of sap. On this subject Mr. Vesque (*Annales Agronomiques*) remarks that Mr. Boehm's results and those that he himself has obtained from analogous experiments show simply that capillarity suffices to keep up the normal transpiration of a plant a few inches in height, but he asks whether, with the elements furnished by Mr. Boehm's memoir and those known up to the present, we can conclude that capillarity, joined to the effects of differences of pressure of inclosed air, suffices to cause the water to rise to more than three hundred feet, the height reached by certain large trees.

It seems, says Mr. Herbert, that we have not as yet sufficient data to solve this problem, and new experiments are necessary. We can only applaud the ingenuity of the methods of investigation employed by Mr. Boehm to verify his opinion that capillarity is the sole efficient cause of the ascent of sap. On the other hand, the objection offered by Mr. Levesque is a serious one, for it does not seem as if capillarity alone can cause sap to rise to a height of more than three hundred feet. We would ask whether it is not in a calorific phenomenon that we must look for the explanation.

Generally speaking, it is through the vacuum produced by the transpiration of the leaves, aided by capillarity, that sap rises. This vacuum is exerted throughout the entire surface of the tree, producing upon it the effect of an immense cupping glass. There is therefore produced upon this surface at the same time, in consequence of the latent heat removed by evaporation, a depression of temperature. On the contrary, in the earth surrounding the roots, and especially through the ligneous tissues, there occur chemical actions that develop heat.

We have therefore at once, from bottom to top, a calorific-electric current, osmosis and capillarity.

Nepenthes not Carnivorous.—A communication from M. Dubois to the Academy of Sciences challenges the so-called carnivorous character generally attributed to the pitcher plants on the assumption that a liquid secreted by them in the pitchers possesses digestive properties (*Compt. Rend.*, cxi., 315). M. Dubois bases his objection upon the results obtained in a large number of experiments made upon plants of *Nepenthes Rafflesiana*, *Hookeriana*, *coccinea*, *phyllamphora*, *distillaria*, *hybrida* and *maculata*. He states that the pitchers of these plants, before the opening of the operculum, were all filled with a limpid slightly acid liquid, but in the open pitchers the liquid was generally turbid, contained insect debris, and sometimes exhaled a strong putrefactive odor. When the liquid was withdrawn from a closed pitcher, or one just ready to open, by means of a sterilized pipette, it remained clear for months, it was free from micro-organisms, and had no effect upon cubes of coagulated albumen placed in it, the angles of which remained intact after several days. The liquid taken from pitchers opened a very short time was also still clear, but it attacked albumen at the ordinary temperature, and very vigorously at a higher temperature. The liquid became turbid and contained numerous micro-organisms. In some cases it developed a putrefactive odor and gave some of the reactions of peptones. Many of the pitchers contained insects, not in the course of digestion, but of putrefaction. M. Dubois concludes therefore that the *Nepenthes* liquor does not contain any digestive constituent comparable to pepsin, but that the phenomena of disaggregation, or false digestion, observed by Sir Joseph Hooker, were due to the activity of micro-organisms coming from outside, and not to a secretion of the plant.

Respiration of Insects.—Mr. Contejean has studied in the grasshopper the little known phenomenon of the respiration of insects. He finds that, contrarily to what occurs in vertebrates, the movement of inspiration is passive, while that of expiration is active. The air is expelled from the insect's body by a contractile effort. The result is that if the animal be wounded, we observe blood to flow at every expiration. Decapitation does not arrest the respiratory movements, no more than does the absorption of curare, which in man produces an immediate cessation.

The Cat in Antiquity.—At a recent meeting of the Academy of Inscriptions, Mr. Saglio discussed the interesting question as to whether the cat of to-day was known to the ancients. We take from the *Temps* the following abstract of Mr. Saglio's remarks:

Was the cat known to the ancients? If so, should it be considered as having been with them a domestic animal or as a tamed one, like the monkey or the gazelle, for example? Such is the question that arose incidentally at the Academy some time ago. At that time, some of the members inclined toward the first hypothesis, while others, taking as a basis the differences established by Virchow, of Berlin, between the Egyptian cats (thousands of mummies of which are found in the necropolises of Egypt) and the cat that we know today, claimed that the animal of antiquity and that of our time were no more the same animal than are the mouse of the present and the mouse of antiquity. The cat of antiquity, according to some, was slimmer, and resembled the weasel more than it did any other animal.

Mr. Saglio presented to his audience the figure and the fac-similes of various monuments in support of an observation that he made at that epoch on the subject of the domestication of the cat among the ancients. These were, primarily, paintings on Etruscan tombs in which cats are represented in the interior of dwellings. In one of them, especially, a kitten, during a repast, is seen playing with other animals under the couches upon which the guests are reclining. We find the cat figured also in the paintings on Greek vases of the fifth century before Christ. Upon two pitchers in the British Museum, the paintings on which seem to be due to the same hand, are to be seen domestic cats in the interior of a school of music. One is tied up by a string, and the other stands upright on a stool, and a young man is offering a cake to it. All these, and similar fac-similes, perfectly authentic, reproduce the image of a cat, perhaps a little slimmer than ours, but exactly like the animal that we now designate by the name.

Sexual Selection in Spiders.—Mr. G. W. and Mrs. E. G. Peckham, in the Occasional Papers of the Natural History Society of Wisconsin, give an account of their observations on sexual selection in spiders of the family Attidæ. However satisfactory Mr. Wallace's explanations may be when applied to birds and butterflies, they fail when applied to spiders. His theory would only partially explain the following facts: Among the Attidæ the males are more brilliant than the females, young males nearly always resemble adult females, the males, when they differ from the females, depart from the general coloring of the group, and females, when they depart from the general coloring of the group, approach the coloring of the males. Mr. Wallace's assumption that the male animal is constitutionally more active than the female is not true of spiders. On the contrary, it is the female that is the more active and pugnacious. In neither sex is there any relation between development of color and activity. When the male is distinguished by brighter colors and ornamental appendages, these adornments are not only so placed as to be in full view of the female during courtship, but the attitudes and antics of the male are at that time such as to display them to the fullest possible extent.

Myrmecophilous Plants.—In the concluding part of his work upon this subject, Professor F. Delpino enumerates as many as 3,030 species distributed through 292 genera, with extra floral nectaries or other contrivances for inviting the visits of ants. The natural orders in which the greatest number of myrmecophilous species occur are Mimoseæ (663), Euphorbiaceæ (482), and Bignoniaceæ (342). The prevalence of the phenomena in any district is nearly proportional to the average temperature. The Central American region produces the largest number (653). The author believes that both ants and myrmecophilous plants came into existence in the cretaceous period.

Secretion of Silk by the Silkworm.—Professor G. Gilson is of the opinion that the silk of the silkworm is a regular secretion product. He bases this view on the facts that the glandular tube is covered internally, throughout its length, with a transparent membrane. This contains circular threads, and the spaces between them are filled with a network formation. As the silk is always separated from the cells by a membrane, it cannot be the result of the direct transformation of the protoplasm. In the next place the silk is not, as a rule, to be detected by any reagents in the body of the cell, but in some cases it becomes really visible. At the end of larval life, certain shining spherules were formed in the cells, and the reactions of these were just the same as those of silk. If one impedes the excretion of the silk at the end of larval life, the cell body becomes quite burdened with silk spherules. It seems that the silk is made up within the protoplasm, and is cast out through the meshes of the net-like membrane. A selection is probably made by the membrane itself among the several substances that are mixed with the liquid part of the protoplasm and the silk, and the substance that becomes the silk is cast out. The special apparatus of the silk duct seems to regulate the diameter of the thread, which is often very irregular before it has passed through it, and probably also to regulate the thickness of the thread.

The Smallest Flowering Plant.—The smallest flowering plant is *Wolffia microscopica*, a native of India. It belongs to the duckweed family. It is almost microscopic in size, destitute of proper stem, leaves and roots, but having these organs merged in one, forming a frond. There is a prolongation of the lower surface, the purpose of which seems to be to enable the plant to float upright in the water. The fronds multiply by sending out other fronds from a slit or concavity, and with such rapidity does this take place that a few days often suffice to produce from a few individuals enough similar ones to cover many square rods of pond surface with the minute green granules. Small as these plants are, they bear flowers. Two are produced on a plant, each of them very simple, one of a single stamen and the other of a single pistil, both of which burst through the upper surface of the frond.

GAS pipes from paper are made from strips of manila paper equal in width to the length of the pipe to be made, which is passed through a vessel with melted asphalt, and then wrapped firmly and uniformly around an iron core until the required thickness is attained. The pipe is then subjected to powerful pressure, after which the outside is strewn over with sand, and the whole cooled in water. The core is then removed and the inside of the pipe coated with a waterproof composition. These pipes are claimed to be perfectly gas tight and much cheaper than iron pipes, and very resisting to shocks and concussions. The claim as to greater cheapness than iron is probably an error.

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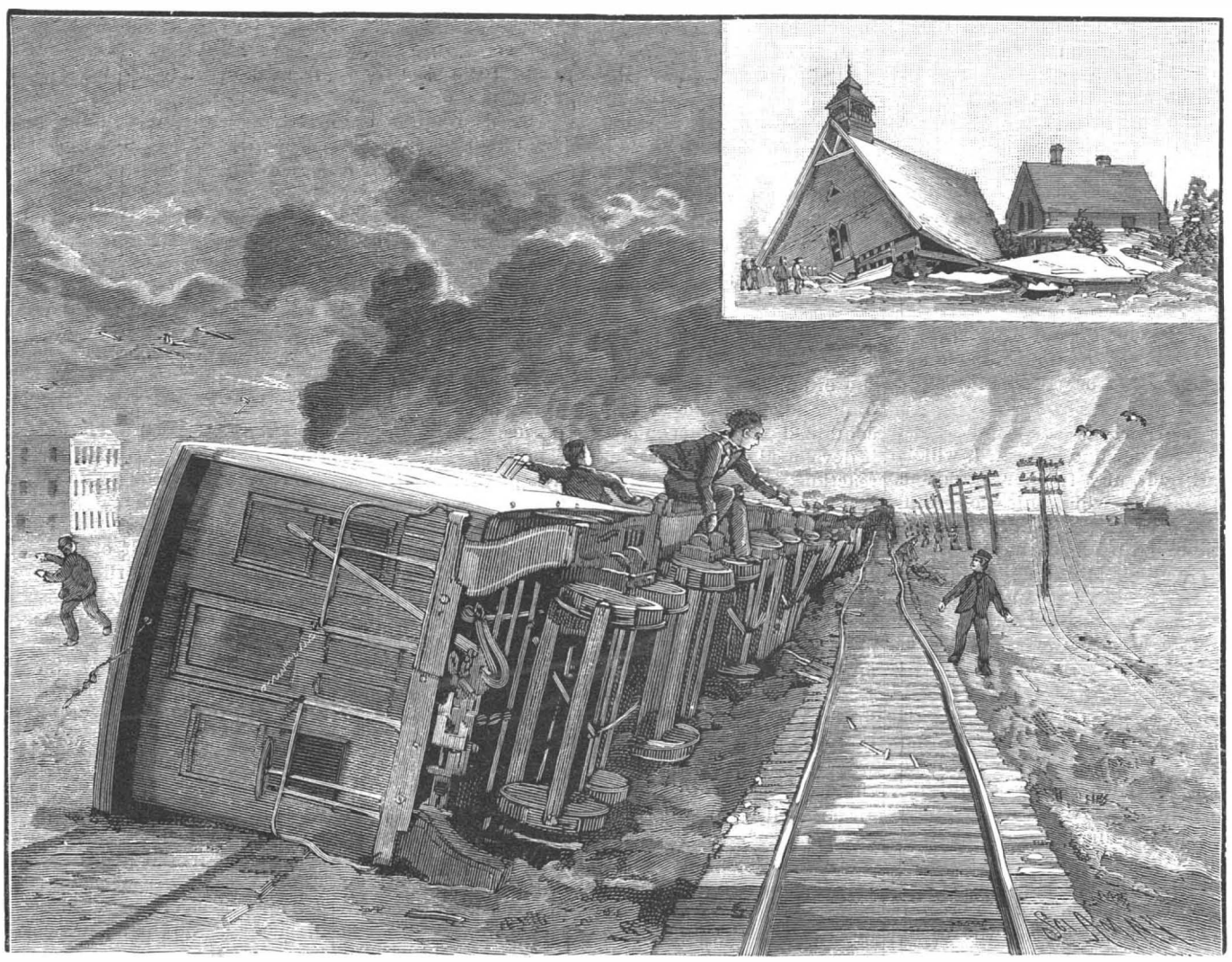
THE TORNADO AT FARGO, NORTH DAKOTA.

The force of the wind storms that are a constant menace to some of the Western States is well illustrated in the accompanying engraving, which has been prepared from photographs taken at Fargo, North Dakota, at the time of the disaster, and kindly sent to us by Mr. S. H. Logan. The most extraordinary feature of the storm was the overturning of an entire railroad train, consisting of three baggage cars and nine heavy sleeping coaches. The locomotive and tender alone remained on the track. The through passenger train arrived at the town of Fargo at the same time as the tornado. As the roofs of the railroad machine shop and freight house were carried away, the engineer thought it safer to move out of the station, but was compelled to stop at the crossing of the Chicago, Milwaukee & St. Paul R.R. He found great difficulty in getting started again, and was moving along very slowly, when suddenly the whole train was turned over. The rate at which they were proceeding was so slow that none of the passengers was seriously injured, although the fright and the nervous and physical shock was very great. Had the train been running at an ordinary rate of speed the consequences would have been frightful. The train was very crowded, containing a number of ladies and children. One of the cars was a "special," and contained a number of officials of the Chicago & Northwestern R.R Co. The accident occurred about 3 o'clock in the morning. Very little damage was done to the cars, as may be seen by scanning the trucks, none of which were wrenched from their positions. The terrible force of the wind is well shown by the lateral displacement of the track, which took place before the cars were overturned. The small view in the upper corner shows the manner in which the Plymouth Chapel, of Fargo, was lifted up and dropped some distance from its foundation.



OVERTURNING OF A TRAIN BY A TORNADO.

The History of Zero.

A writer in the N. Y. *World* suggests that this is about the time of year that we all begin to think of "zero." It is the part of every thermometer that is most watched and dreaded in this changeable climate of ours. The word is from the Spanish, and means empty, hence nothing. It was first used on a thermometer in 1709 by a German physicist named Fahrenheit.

From a boy he was a close observer of nature, and when only nineteen years old, in the remarkably cold winter of 1709, he experimented by putting snow and salt together, and noticed that it produced a degree of cold equal to the coldest day of the year.

As that day was the coldest day that the oldest inhabitant could remember, Gabriel was the more struck with the coincidence of his little scientific discovery, and hastily concluded that he had found the lowest degree of temperature known in the world, either natural or artificial.

He called the degree zero, and constructed a thermometer, or rude weather glass, with a scale graduating up from zero to boiling point, which he numbered 212, and the freezing point 32, because, as he thought, mercury contracted the thirty-second of its volume on being cooled down from the temperature of freezing water to zero, and expanded one hundred and eightieth on being heated from the freezing to the boiling point.

Time showed that this arrangement, instead of being truly scientific, was as arbitrary as the division of the Bible into verses and chapters; and these two points no more represented the real extremes of temperature than from "Dan to Beersheba" expressed the exact extremes of Palestine.

But Fahrenheit's thermometer had been widely adopted, with its inconvenient scale, and none thought of any better until his name became an authority, for Fahrenheit early in life abandoned trade and gave himself up to science. Then habit made people cling to the established scale, as habit makes the English cling to the old system of cumbrous fractional money.

The three countries using Fahrenheit are England, Holland and America. Russia and Germany use Reaumur's thermometer, in which the boiling point is counted 80 degrees above the freezing point. France uses the Centigrade thermometer, so called because it marks the boiling point 100 degrees from freezing point.

On many accounts the Centigrade system is the best, and the triumph of convenience will be attained when zero is made the freezing point, and when the boiling point is put 100 or 1,000 degrees from it, and all the subdivisions are fixed decimally.

If Fahrenheit had done this at first, or even if he had made it one of his many improvements after the public adopted his error, the luck of opportunity, which was really his, would have secured to his invention the patronage of the world.

The Class of People Out of Employment.

I once heard a gentleman of experience, says a writer in *The Office*, give expression to his views concerning those who are out of employment in about the following terms:

"I seldom find anybody out of work except those who are looking for something that they are incompetent to perform. A man who is able to adapt himself to circumstances and takes any job which offers is never out of employment, and it is only for a short time at most that he is obliged to do anything that is really beneath his ability. As soon as he demonstrates to his employer his fitness for a higher position, he is sure to be promoted. Those who aspire to something above their ability, however, are very numerous. Many of these are actually ignorant of the fact that they are unqualified for the kind of work they are seeking. It would be a mercy to many such men if some one would tell them kindly that their search is in vain, because other men are better qualified to perform the duty they aspire to than themselves, and will therefore be preferred. There is many a man who would make an excellent porter that fritters away his life as a lame excuse for a bookkeeper."

An illustration of a man seeking something to do for which he is utterly unqualified was recently told in one of the daily papers in the following language: A farmer, not less than 65, entered the office of a cotton mill the other day and asked the genial agent for a job at bookkeeping. He said he'd farmed it from a boy up, and that he had decided to try something easier the rest of his days. He said, too, that he had not been educated in keeping books, but he was confident he could do it. The agent who tells of the incident says he heard the old gentleman's story and kindly told him that he saw no vacancy then, but that he would remember him.

The New York Pasteur Institute.

Dr. Paul Gibier, director of the New York Pasteur Institute, states the results of the preventive inoculations against hydrophobia performed at this institute, since its opening (February 18, 1890), as follows:

Six hundred and ten persons, having been bitten by dogs or cats, came to be treated. As to 480 of these persons it was demonstrated that the animals which attacked them were not mad. Consequently the patients were sent back after having had their wounds attended, during the proper length of time, when it was necessary. Four hundred patients of this series were consulted or treated gratis.

In 130 cases the anti-hydrophobic treatment was applied, hydrophobia having been demonstrated by veterinary examination of the animals which inflicted bites or by the inoculation in the laboratory, and in many cases by the death of some other persons or animals bitten by the same dogs. All these persons are, to-day, enjoying good health. In 80 cases the patients received the treatment free of charge.

Employer and Employe.

We once knew a cotton mill superintendent who seemed to have an easy time of it. A woolen mill superintendent who envied him his position asked him what was the most difficult thing about cotton mill superintending, when he dryly answered, "Getting the position." From our observation we should say that keeping a position after it was obtained was the most difficult part of the undertaking. Few people deliver in the shape of service what they bargain to deliver, hence we see good men secure good positions and keep them for a year or two, and then lose them. They were not discharged and they did not leave. "Big head" is sometimes the cause; big head seldom gives one dollar's worth for a dollar, hence dissatisfaction follows; big head gets so important that he thinks time tables were not made for him. In fact, he sometimes gets more important than his employer; when he gets to this stage he is ripe, and should quit and get a position as an oil drummer. There is another class of men who are smart enough, but they have always some business outside of the mill to attend to. In fact, they are trying to serve two masters equally well, and no one has yet succeeded in doing it. The result is, the time table is neglected, and pay day looked for as if it was the most important thing in life, all of which is noticed by the employer, and the employe is put in the balance and found wanting, and a change of position is the result, bringing a loss to both parties. A great many good men lose positions because they do not give a dollar's worth for a dollar. This may come about in many different ways, but no matter what the cause, employer and employe suffer alike both in mind and finances, and there is a breaking up of homes and changes to new localities, all of which could be avoided by a proper understanding of what constitutes *thine* and *mine*.—*Wade's Fibre and Fabric.*

THE effect of stained woods for interior decoration is so far superior to paint that it may be said, for inside work, wood painted is wood spoiled. The stains are so readily made and so easily applied that they can be used with charming effect by those entirely ignorant of the painter's art. In general terms it may be said that all of the transparent colors can be used as stains if sufficiently diluted with turpentine. The important point in preparation is that the stain should be very thin, it can hardly be made too thin, as a second or third coat will deepen the color.

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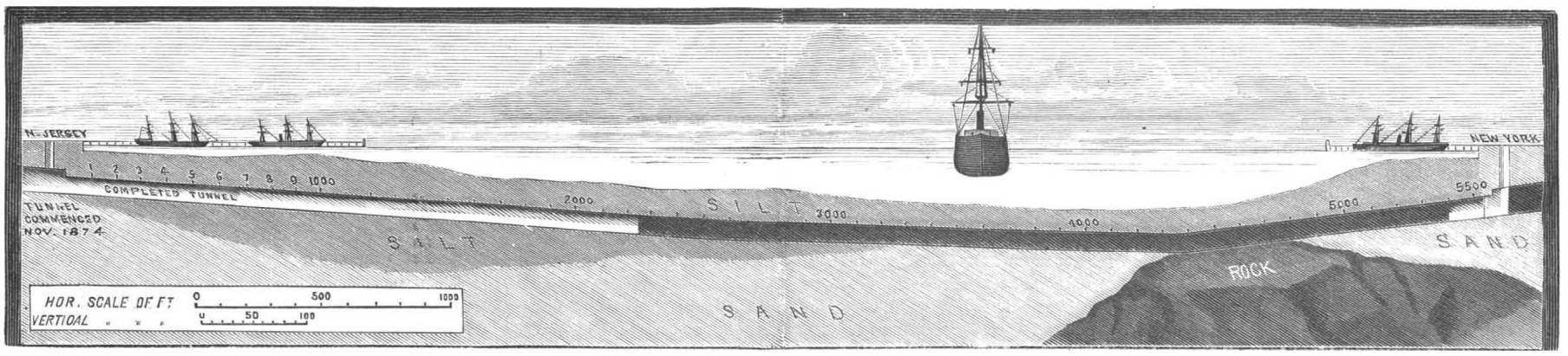
PROGRESS OF THE GREAT RAILWAY TUNNELS UNDER THE HUDSON RIVER BETWEEN NEW YORK AND JERSEY CITY.

This great enterprise, after several years of comparative inaction, has passed into the hands of new managers, having abundant capital, and under the new auspices the work of construction has been resumed in the most vigorous and active manner, with promise of early completion. The affairs are now controlled by London capitalists, and Sir John Fowler and Sir Benjamin Baker are the consulting engineers.



THE HUDSON RIVER TUNNEL.

The heavy dark line shows the uncompleted portion.

The original projector of the Hudson River tunnel was Mr. Dewitt Clinton Haskin, of New York, formerly of California, who was one of the active spirits in the construction of the Union Pacific Railway. He foresaw the great importance and value of this tunnel, and at his own expense made the preliminary surveys and soundings necessary to determine the feasibility of the structure and the proper location of the line.

The work of constructing the tunnels was commenced by Mr. Haskin in 1874. A circular working shaft 30 feet in diameter was begun, to be 65 feet deep, the location being on Fifteenth Street, Jersey City, one hundred feet inside of the bulkhead line of the river. The shaft had hardly been sunk for half the proper depth when further progress was enjoined at the instance of the Delaware, Lackawanna and Western Railroad Co. A long delay ensued, but the right of the Tunnel Co. to proceed was finally established, the shaft was completed, an enlarged chamber was made at the foot of the shaft, and from this chamber the headings of two parallel tunnels were started, on a gentle grade, to descend under the great river.

Some time after this the sinking of a vertical shaft on the New York side was begun near the bulkhead at the foot of Morton street.

The distance between the two shafts is about 5,400 feet. Including the proper approaches, the total length of the work will be about 12,000 ft.

One of our illustrations shows a side sectional view of the north tunnel, the light portion indicating the part that has been completed up to date, namely, about 2,300 ft. on the Jersey side and about 250 ft. on the New York side. The dark line shows the uncompleted portion.

In the construction of the tunnel Mr. Haskin had his own peculiar views and was his own chief engineer. He insisted that the use of protecting shields and other devices were unnecessary and, in fact, a hindrance. Contrary to the recommendations of engineers, he relied wholly upon compressed air as a means of temporarily upholding the walls of the earth until the masonry of the tunnel could be put in.

It was a bold undertaking, and its failure was confidently predicted. But Mr. Haskin went ahead with his remarkable work, his plan of using compressed air proved valuable, and when worked in strict accordance with his directions, was successful. Owing, however, to carelessness of workmen in not watching and stopping air leaks with sufficient alacrity, it was deemed best, as an additional element of safety, in 1880, to make use of Mr. J. F. Anderson's pilot tunnel at the heading. This consisted of a six foot iron tube carried into the ground ahead of the tunnel in the middle of the heading. It was used as a center upon which braces were placed to hold up the iron plates, the setting of which was begun at the top of the tunnel. The pilot tunnel also served to indicate in advance any change in the character of the soil.

Mr. Haskin had completed nearly two thousand feet of the tunnel when, in 1882, on the decease of one of his principal financial supporters, the late Trenor W. Park, he was obliged to diminish his force of workmen and practically to suspend operations until new monetary arrangements could be made. No man ever battled more bravely against physical and financial obstacles than did Mr. Dewitt C. Haskin as the projector and constructor of the Hudson River Tunnel. As an engineer he deserves high credit, for he has made known to the profession a mode of using compressed air in river tunnel work that is of much value and importance.

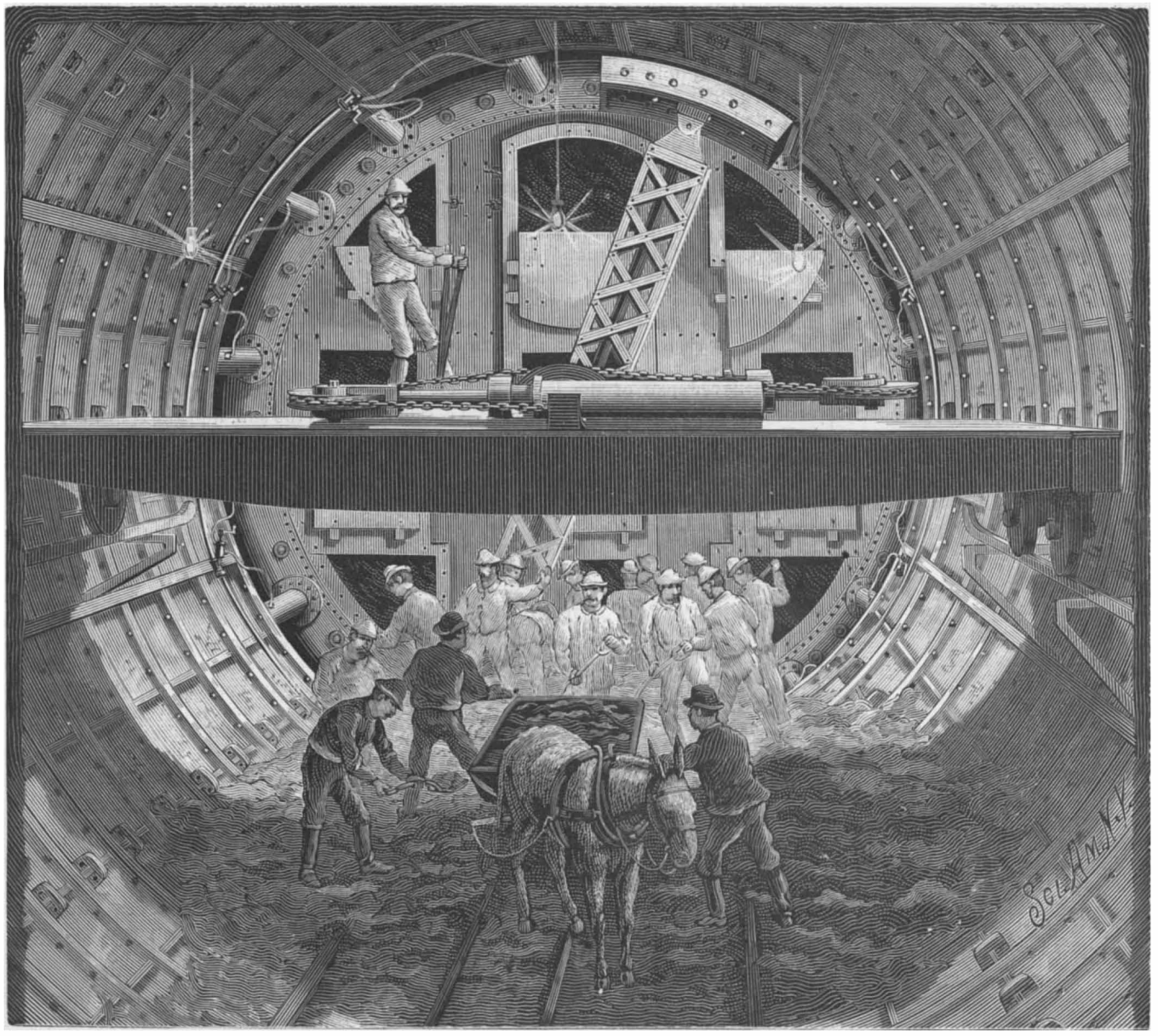
Prior to Mr. Haskin's time compressed air had been used in caissons in the sinking of vertical shafts, by means of which air it was possible to prevent the rise of water through the soil composing the bottom of the excavation.

But we believe Mr. Haskin was the first to conceive and put into actual practice the idea of employing compressed air in a horizontal tunnel, for the purpose of assisting to uphold the earth of the side walls, ceiling and heading so that the same could be excavated and the masonry or iron tunnel put therein. This method was patented by Mr. Haskin February 3, 1874, and in his patent he thus expresses his ideas:

"My invention relates more especially to the construction of tunnels through sands, wet earths under water courses and under such like conditions where the caving-in of the walls of the excavation or the infiltration or irruption of water is to be apprehended. Its object is to effectually prevent such incidents in a cheap and simple way, to which end my improvement consists in filling the excavation with compressed air of a density sufficient to resist the inward pressure during the construction of the shell or wall of the tunnel.

"The distinguishing feature of my system, however, is that instead of using temporary facings of timber or other rigid material, I rely upon the air pressure to resist the caving-in of the wall or the infiltration of water until the masonry wall is completed. The pressure is, of course, to be regulated by the exigences of the occasion, and may be varied from anything above that of the atmosphere to 50 lb. to the square inch, which is about as much as the human system will bear with safety. The effect of such pressure has been found to be to drive water in from the surface of the excavation, so that the sand becomes dry."

Having thus briefly brought down the history of this important work from its inception in 1874, let us glance at its present active condition and the methods for working that have been adopted by the London company. Mr. Haskin's method of using compressed air is still used, and is found to be indispensable. But as an engineering precaution, and to assist in the more rapid prosecution of the work, the Beach hydraulic shield has been introduced. Furthermore, iron plates much thicker and stronger than those before used have been adopted for the outer walls of the tunnel. Our readers are familiar with the history of this form of shield. It was designed and first constructed by Mr. A. E. Beach, one of the editors and proprietors of the SCIENTIFIC AMERICAN. It was first used in con-



THE HUDSON RIVER TUNNEL—THE "ERECTOR" AND THE HYDRAULIC SHIELD.

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structing a short section of the projected Broadway underground railway in this city, 1868–69. The two tunnels under the Thames River and parts of London, for the new London underground electric railway, shortly to be opened to the public, were built by means of these shields; also the great railway tunnel under the St. Clair River, between Port Huron, Mich., and Sarnia, Canada.

Referring now to our front page illustrations, we give, at Fig. 1, a perspective front end view of the shield.

It resembles a gigantic barrel without heads; its front end is provided with an inclined cutting edge, with horizontal and vertical braces or stanchions, back of which are strong vertical bulkheads or diaphragms, in which are a series of doors. Arranged around within the outer walls of the shield are a series of hydraulic jacks of great power, all operated by a common pump, but each jack provided with a stop cock, so that all or any one, or any desired number of the jacks, may be worked at once, as desired. A glance at the engravings will show the positions of these jacks.

The shield thus constructed is placed in the heading of earth, and the front end of the tunnel is covered by and inclosed within the rear part of the shield. The latter may be said to form a protecting cap or cover to the front end of the tunnel, and prevents the caving in of the earth upon the workmen. When the shield is to be advanced the hydraulic pump is set in motion and the jacks are made to bear with great force against the front end of the tunnel as shown in Figs. 1, 2, 3. This drives the shield ahead into the clay or silt, which consequently enters the front of the shield, through the doors before mentioned; a stream of the silt comes in at each door, and is broken off into blocks by the men, as shown in our illustrations. The pressure on the jacks is now stopped and the pistons of the jacks pushed back within their cylinders, which leaves a free space within the rear part or hood of the shield, and in this space a new section of the tunnel is built up and joined to the front end of the tunnel. The new section now becomes the front end of the tunnel, and against it the jacks are now pushed to send the shield again ahead. The extreme front end of the tunnel is thus always protected and covered by the shield.

The resistance encountered by the shield arises not so much from the cling or friction of the silt against the surface of the shield as it does from the small area of the door openings compared with that of the entire bulkhead or diaphragm. There are nine doors or openings in the bulkhead, and consequently nine streams of silt pour simultaneously into the shield when it is pushed ahead.

The general method of carrying forward the work is extremely simple. At 1,250 feet from the shore in the north tunnel from the Jersey shore is a masonry bulkhead containing the first air lock. Three hundred and fifty feet beyond this is a second air lock, and about 1,900 feet from the shaft is still a third air lock, through which the working chamber or heading is entered. This air lock consists simply of a boiler shell 6 feet in diameter by 15 feet long, provided at each end with a 3 by 4 foot door, opening toward the shaft. Through these pass all supplies and all excavated material, a car track running from the shaft down to the heading.

The external diameter of the shield is 19 feet 11 inches, its length being 10½ feet. The outer or cylindrical portion consists of two thicknesses of steel plates five-eighths of an inch thick. The bulkhead, which divides the shell transversely into two parts, is built of steel five-eighths of an inch thick, and is placed 5⅔ feet from the forward edge. In this division are the nine doors above mentioned. The shield is also divided horizontally and vertically by two diaphragms built of double half-inch plates. The inner shell of the shield—for it must be mentioned that the cylindrical part is formed of two concentric shells, which are separated from each other a distance of 1 foot 5 inches—is composed of one-half inch plates, and it extends from the center bulkhead to within 2⅓ feet of the cutting edge.

These two shells are securely united. Between the shells are carried the cylinders of sixteen twenty-ton hydraulic jacks. The plungers of these have a bearing against the rings of completed plates forming the tunnel proper. Each ring is formed of flanged cast iron plates 1¼ inch thick, the flanges being 1½ inches thick and 8 and 9 inches deep. The flanges are cast with holes, in order that they may be bolted together.

They are placed in position by a hydraulic segment erector shown in the engraving on page 279. This is carried in the center of a girder spanning the completed work, and provided at each end with two double-flange wheels which run upon a track, fitted to brackets held to the flanges of the rings of plates in position. In this way the girder and the erector it carries can be moved longitudinally as desired. The frame spanning the tunnel consists of two girders, each of which carries a cast iron hydraulic cylinder, the two being counterparts of each other. These cylinders are six feet long and the rams working in them are 6½ inches in diameter. To the head of each plunger is fixed a pulley, 17 inches in diameter. Now, between the rams is a cast iron drum 2¼ inches in diameter by 12 inches face. The weight of the cross head of the plunger is supported by a pair of 4-inch wheels bearing on a flange of the girders. A chain passes from a bracket on each ram over the pulley on the end of the plunger and then to the drum between the cylinders, the strokes of the plungers being so adjusted that when one is moving forward the other is moving to the rear or further in its cylinder. Any movement, therefore, of the rams must of necessity result in revolving the drum. A shaft seven inches in diameter connects the drum with the main arm of the erector, which is placed just outside of the forward girder. This arm is 14½ feet long and is so mounted that it can be moved in a direction at right angles to the shaft by means of a double ram placed inside of it. The erector is controlled from a platform by a pair of levers, one regulating the pressure to the cylinders on the bridge girder and thereby revolving the erector as may be necessary, and the other governing the pressure to the cylinder of the erector.

If what we may term the gripping end of the arm be deflected until it is directly over one of the plates to be lifted into place, and is then moved downward so that a bolt can be passed through two arms on its end, which are placed each side of a perforated lug cast in the middle of the plate, the erector is in position to lift one plate. The arm of the erector is then moved upward until it is known that the plate will clear any obstruction, and is then swung in a circle whose plane is vertical until it is in a line with the space to be occupied by that plate. It is then so moved as to place the plate in position, when it holds it there until the bolts have been inserted. The whole operation is extremely simple, and is clearly shown in the cut on the preceding page, and, so far, has been found to work to good advantage.

The silt which comes through the shield is taken back in a car to a hydraulic elevator, where it is lifted about twelve feet to the level of the track extending up through the tunnel. The tunnel is left a little over half full of material, it being deemed more economical and expeditious to let this remain, and remove it after the completion of the work.

The air pressure now used is between 35 and 40 pounds to the inch, and serves the important purpose of counterbalancing the water pressure on the shield, thus enabling the jacks to push the shield ahead.

So far no trouble has been experienced in keeping the work to line. A change of direction of movement is effected by employing those jacks opposite to which it is desired to deflect the shield. By using the jacks on the right hand side, the shield can be made to move further toward the left. The average rate of progress is about four feet a day, the work being carried on in three shifts of eight hours each.

The *personnel* of the tunnel is as follows: Sir John Fowler and Sir Benjamin Baker, who built the Forth Bridge, are the cousulting engineers; Mr. Wm. R. Hutton, under whose direction the Washington Bridge over the Harlem was constructed, is chief engineer; Mr. E. W. Moir, who had charge of the erection of one cantilever span of the Forth Bridge, is engineer for the contractors, Messrs. S. Pearson & Son; Mr. C. A. Haskin, a son of the projector of the tunnel, is the superintendent.

The form of Beach shield here used and the hydraulic gear were designed by Mr. E. W. Moir, under Sir Benjamin Baker's directions. The erector was also designed by Mr. Moir. All the parts were constructed by Sir William Arrol & Co., at their Glasgow shops.

Lake Shipbuilders.

Our esteemed contemporary the SCIENTIFIC AMERICAN, which endeavors to embrace each and every United States project, in invention and industry, devotes in the current issue its front page illustration to the launch of the Norman, built at the yards of the Globe Iron Works Company Cleveland, O. The Cleveland Drydock Company is also ably delineated in the above valuable journal.

We have for the past thirteen years ably held forth on the merits abounding in the Western and Northwestern States, more particularly in the special line of shipbuilding and fitting out. We are now more than pleased to find that our Eastern contemporary is inclined to do us a little justice by ventilating the subject which we have so repeatedly and in good season duly heralded in the columns of *The Marine Record.*

The press of the world must eventually admit the pre-eminence of the lake shipbuilding, although the most enterprising of publications will, according to the direct order of things, take hold of the facts a little ahead of its contemporaries, hence we heartily congratulate the SCIENTIFIC AMERICAN upon thus reproducing our many well timed and successful heraldings of the chief industry of Cleveland, O., which has already fully earned and justly obtained the title of the center of lake shipbuilding, and, as such, her record is in a fair way of being maintained for many years to come, as the capital, material, talent, and sinew are now thoroughly intrenched in that favored city. We therefore extend our congratulations to our New York contemporary for realizing in so striking a measure the necessity of paying at least a passing attention to the most important industry extant, viz., the shipbuilding of the Great Lakes.—*The Marine Record.*

The Use of Water at Meals.

Opinions differ as to the effect of the free ingestion of water at meal times, but the view most generally received is probably that it dilutes the gastric juice and so retards digestion. Apart from the fact that a moderate delay in the process is by no means a disadvantage, as Sir William Roberts has shown in his explanation of the popularity of tea and coffee, it is more than doubtful whether any such effect is in reality produced. When ingested during meals, water may do good by washing out the digested food and by exposing the undigested part more thoroughly to the action of the digestive ferments. Pepsin is a catalytic body, and a given quantity will work almost indefinitely, provided the peptones are removed as they are formed. The good effect of water drunk freely before meals has, however, another beneficial result—it washes away the mucus which is secreted by the mucous membrane during the intervals of repose, and favors peristalsis of the whole alimentary tract. The membrane thus cleansed is in a much better condition to receive food and convert it into soluble compounds. The accumulation of mucus is especially well marked in the morning, when the gastric walls are covered with a thick, tenacious layer. Food entering the stomach at this time will become covered with this tenacious coating, which for a time protects it from the action of the gastric ferments, and so retards digestion. The tubular contracted stomach, with its puckered mucus lining and viscid contents, a normal condition in the morning before breakfast, is not suitable to receive food. Exercise before partaking of a meal simulates the circulation of the blood and facilitates the flow of blood through the vessels. A glass of water washes out the mucus, partially distends the stomach, wakes up peristalsis, and prepares the alimentary canal for the morning meal. Observation has shown that non-irritating liquids pass through the "tubular" stomach, and even if food be present, they only mix with it to a slight extent. According to Dr. Leuf, who has made this subject a special study, cold water should be given to persons who have sufficient vitality to react, and hot water to others. In chronic gastric catarrh it is extremely beneficial to drink warm or hot water before meals, and salt is said in most cases to add to the good effect produced.—*British Medical Journal.*

The Compass in the Watch.

A correspondent of the London *Truth* sends the following: "A few days ago I was standing by an American gentleman, when I expressed a wish to know which point was the north. He at once pulled out his watch, looked at it, and pointed to the north. I asked him whether he had a compass attached to his watch. 'All watches,' he replied, 'are compasses.' Then he explained to me how this was. Point the hour hand to the sun, and the south is exactly half way between the hour and the figure XII, on the watch. For instance, suppose that it is 4 o'clock. Point the hand indicating 4 to the sun and II on the watch is exactly south. Suppose that it is 8 o'clock, point the hand indicating 8 to the sun, and the figure X on the watch is due south. My American friend was quite surprised that I did not know this. Thinking that very possibly I was ignorant of a thing that every one else knew, and happening to meet Mr. Stanley, I asked that eminent traveler whether he was aware of this simple mode of discovering the points of the compass. He said that he had never heard of it. I presume therefore, that the world is in the same state of ignorance. Amalfi is proud of having been the home of the inventor of the compass. I do not know what town boasts of my American friend as a citizen."

Watching the Clock.

As the *Christian Union* says, there is a deal of common sense in this story lately told of Edison, whether he said it or not. A gentleman went to the great electrician with his young son, who was about to begin work as office boy in a well known business house. The father asked Edison for a motto which the boy might take to heart in his struggle for promotion and success. After a moment's pause, Edison said, laconically, "Never look at the clock!"

Edison, meant, we take it, that the man who is constantly afraid he is going to work overtime or overhours doesn't stand a chance of competing with the man who clears up his desk, no matter how long it takes. The carpenter who drops his hammer, uplifted above his head, when the whistle blows, is likely to remain a second class workman all his life. The carpenter who stays fifteen minutes to finish a "job" is working toward a shop of his own.

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PHOTOGRAPHIC NOTES.

The "Wet" Orthochromatic Process.—Mr. Max Jaffe, proprietor of a photographic art printing and engraving establishment at Vienna, publishes in *Photographie* the orthochromatic process which is in practical use in his establishment, and which, as he says, is a modification of the process published in 1878 by Ducos du Hauron. The main points of this practical process are the following: In 250 c.c. of alcohol of 95 per cent, 2·2 grammes of eosine are dissolved, then 45 grammes of cadmium bromide; the solution is filtered, and 250 c.c. of sulphuric ether added to it. The whole is, with repeated shaking, added to 1,000 c.c. of 2 per cent plain collodion. The sensitizing solution consists of:

Water	1,000 c.c.
Silver nitrate	165 grammes.
Conc. nitric acid	about 10 drops.

The plates are allowed to remain in this solution until the film has acquired a good density, which will take about ten minutes. The plates being highly yellow-sensitive, yellow light must of course be avoided in the dark room. The exposure must be increased for about one half of that required in the case of ordinary wet collodion plates. After exposure the plate is directly developed with the following iron developer:

Water	1,000 c.c.
Sulphate of iron	40 grammes.
Alcohol	30 c.c.
Sulphuric acid	12 drops.

The image comes out quickly, the deposit being produced at the end of the development. It disappears if the plate is sufficiently rinsed. The plate is then, as usual, fixed in a concentrated solution of hypo, and then washed. The red tint of the film, owing to the eosine with which it has been stained, renders it difficult to judge whether the plates have been correctly exposed; it is, therefore, desirable to remove the red stain. This may be done at once by pouring over them water to which a few drops of hydrochloric acid have been added. The same end is, of course, attained by prolonged washing with plain water. The plates treated by this method are specially sensitive to yellow and green. If the subject to be reproduced contains a good deal of blue, a yellow screen must be used. Deep red comes in the reproduction as dark as in the ordinary process; this may, however, be compensated for by intensifying the parts of the negative which are without the required density. Mr. Jaffe suggests to make use in such cases of very fine graphite (blacklead), which is applied to the weak parts of the negative by means of a leather stomp. This method of local intensification may as well be employed in cases where there have been two different colors, side by side, in the original of equal luminosity, and which on the negative have been reproduced equal in tone, in order to produce a certain amount of contrast.—*H. E. Gunther, in Photo. News.*

Combined Hydroquinone and Eikonogen Developer.—In consideration of the fact that eikonogen, *per se*, tends to give flat negatives, though the energy of the developer is impaired, and that hydroquinone, *per se*, acts rather slowly, giving, however, great density, a combined hydroquinone and eikonogen developer is used and strongly recommended by a well known amateur photographer. Its composition is the following:

No. 1.

Sulphite of soda cryst.	60 grammes.
Cryst. soda	40 "
Distilled water	1,000 c.c.

After solution, to be filtered; keeps any time.

No. 2.

Eikonogen	50 grammes.
Hydroquinone	50 "

Are placed together in a porcelain mortar, rubbed down to fine powder, and then kept dry for use in a well stoppered glass bottle. For use, take 1 gramme of No. 2 and dissolve it in 100 c.c. of No. 1. The solution keeps well for several weeks. This developer is said to possess all the advantages of the hydroquinone, iron oxalate, and pyro developers, without their disadvantages. The greatest advantage, however, consists of the fact that the developer, if larger quantities are to be prepared, is always ready at hand, and that larger or smaller quantities may always be prepared without any delay. —*H. E. Gunther, in Photo. News.*

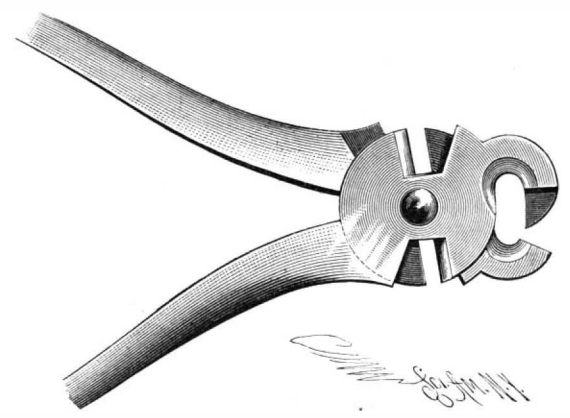
First Class Paste.

Take a quart of water and dissolve in it a teaspoonful of pure powdered alum. Stir into this enough of flour to make a thick cream. Break up every little lump of flour until the mixture is smooth. Stir in next a teaspoonful of powdered resin. Now pour in a cupful of *boiling* water. Stir it all well. For your nosegay mix in a few drops of oil of cloves, or wintergreen, or sassafras, as you prefer. When the mixture has thickened from cooking by the boiling water, pour into an earthen vessel—not a tin can. Cover it up and keep it in a cool place. Whenever you want to use any portion of it, take what you need and soften it with a little warm water.

This will give you a perfect paste, clean, wholesome, and lasting. You will be surprised how little waste you will have. Should you need larger quantities, increase the proportions in proper ratio, doubling or trebling each ingredient, according to the magnitude of the business requiring it.—*American Art Printer.*

AN IMPROVED FUSE CAP FASTENER.

The device shown in the illustration, which has been patented by Mr. N. W. Moodey, of Fresno City, Cal., is especially designed as an improved implement for fastening the caps on fuses employed in exploding giant powder. The pliers are formed of two similar parts, connected by the pivotal rivet, each part having a cheek with notches, at the sides of which are cutting edges. The curved jaws beyond the cheek pieces,

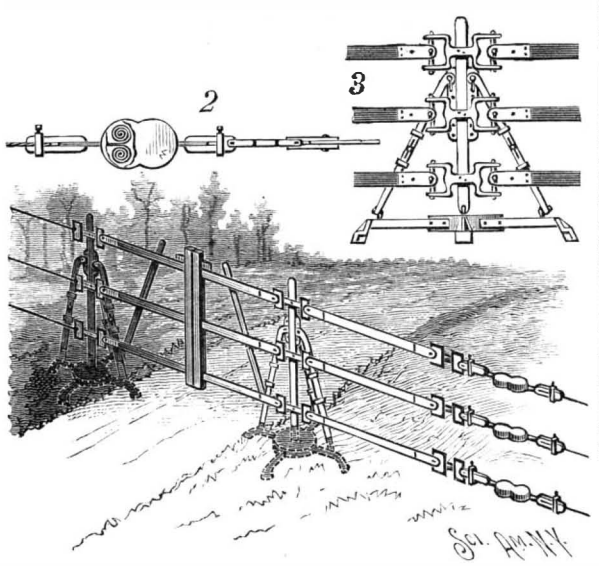


MOODEY'S FUSE CAP FASTENER.

when closed, form a circular aperture, around which the jaws are beveled, one jaw having a tongue which fits in a groove in the other jaw. The pliers are employed for contracting the end of the cap on the fuse, thereby avoiding danger in digging out the explosive in case of bad fuse being used.

AN ADJUSTABLE POST AND EXPANSIBLE JOINT FOR WIRE FENCES.

In the fence construction shown in the illustration, and which has been patented by Mr. John M. Fellows, of Burlington, Ind., the post is adapted to be adjusted to vertical position when its base is on inclined ground, and the fence wires are permitted to expand and contract. The post is provided with a four-armed base, on which the post proper engages a central hook, as shown in Fig. 3, adjustable brace bars extending from near the top of the post to the extremities of the arms of the base. These brace bars are formed in two parts, adjustably held together so that they may be lengthened or shortened, the top section being adapted for attachment to the post by means of a pin passed through one of a series of slots or holes in flanges on the post. In the joint, shown in Fig. 2, is employed a bar having each of its ends U-shaped, the arms in each case being adapted to swing apart sufficiently to receive a roller, and the forked end of a fence rail being secured to one of these rollers by means of a locking pin. To the other roller is pivoted a forked clamp having a sleeve and a clamping screw adapted for attachment to the outer ends of metallic strips, the inner ends of which are held as coiled springs in a suitable casing, similar me-



FELLOWS' IMPROVEMENT IN WIRE FENCES.

tallic strips, with coiled spring ends in the casing, extending from its opposite side to engagement with the clamping block of a fence wire. As many of the bars with U-shaped ends are used as there are fence wires to be strung, the bars being secured to the posts at proper distances apart, thereby allowing the ends of a fence section to be readily secured in place, and by means of the coiled springs, permitting of the expansion and contraction of the fence wires, and making a strong and durable fence.

An Alleged Remedy for the Potato Disease.

In a pamphlet of the Danish Professor J. L. Jenson, Director of "Bureau Ceres" in Copenhagen, he says:

The potato disease first appears in the foliage of the plant, and then spreads to the tubers. The disease consists of a fungus, the spores of which propagate at an extraordinarily rapid rate, and are blown by the wind from field to field, as well as from plant to plant. By a great number of experiments, carried out very carefully all over Denmark, it was found that the disease spread from the foliage down to the tubers in about seven days after the foliage was attacked. The way it spread was by the spores falling from the leaves and stem of the plant on to the soil and being then washed down to the tubers by the rains. On taking up the potatoes in layers, the top layer, consisting of those nearest the surface and nearest the stem, was diseased to the extent of about 80 per cent, the middle layer to the extent of 30 per cent, while the lowest layer was only diseased to the extent of 3 per cent.

Those potatoes nearest the stem of the plant were also always found worse diseased than those farther away. This also went to prove that the spores came from the surface, and in this case came down the opening in the soil made by the stem. This gave the idea that the spores could not reach the tubers if the soil was dense enough, and a great number of experiments were tried all over the country to prove or disprove this idea. The result was startling, and may be roundly put as follows: Where no "moulding" or earthing up was done the percentage of diseased potatoes was 34, where the moulding was imperfect 12, and where the moulding was perfect 1 only!

Some 150 farmers were engaged in these experiments, and the results were all carefully tabulated, and the experimental fields visited and carefully inspected. The knowledge thus obtained proves that to entirely prevent the spores of disease reaching the potatoes it is necessary: 1st. To plant the seeds about 12 inches apart, and have the rows about 30 inches apart. 2d. To mould up into a broad ridge, 3 or 4 inches high and 10 to 12 inches wide, after the first weeding. 3d. To mould up again when the disease first appears in the leaves of the plant, or within seven days of its appearance. The second moulding up to be as high as possible, and so arranged as to bend over the tops of the plant, so that the spores when mature may fall into the space between the rows, and not on the ridges. This can be done by earthing up on one side only. There should not be less than 3½ inches of soil on the top of the uppermost layer of tubers. It was found that one moulding up would not do. If the ridges were moulded up high enough to repel the disease at the beginning, the crop of potatoes was less, in consequence of the young plant being too much covered up. The first moulding or earthing up should be when the usual weeding takes place, and should be flat and broad. The second moulding should not be done till the disease shows itself in the plant.

A small special experiment was made in one field where the disease was very prevalent. In the second "high moulding up" the soil was beaten close with the spade as the operator went along, and this so effectually kept out the disease that the percentage fell from 64 to 0. Hardly a bad potato could be found, though two-thirds were bad in the ridges not moulded up. It was found that the presence of worms, grubs, etc., in the soil increased the disease in proportion to their numbers, that is, their boring operations let in the disease spores through the soil.

Though the method of double earthing up was found to almost entirely protect the potatoes from the disease, it was feared that, when taken up, they would still come in contact with the spores while being taken up, and thus become infected after all. A great many experiments were made on this point, and the results may be put as follows: If taken up before the tops had completely withered, they did become infected, and to a very large extent. If the tops were cut off and taken away before the tubers were lifted, disease still showed itself in a few days, though they were perfectly sound when taken up. This was expected, as the spores which had already fallen from the tops were on and in the soil. If the tops were allowed to completely wither before the tubers were lifted, the spores died from want of food, and no disease whatever showed itself, either at lifting or afterward. If the tops were cut and taken away as soon as the tubers were ripe and before the spores had fallen in any great quantity on the soil, the disease which made its appearance in the potatoes was not very great. If the tops were cut and taken away, and the tubers not lifted for another week or so, very little disease resulted, as the spores were mostly dead. If the tops were allowed to wither, and then a month allowed to lapse before the tubers were taken up, no disease at all ever manifested itself, and it is believed that a fortnight's time would have been equally effective.

COMPRESSED paper is used now as a substitute for wood, in the manufacture of shuttles and their wheels, for looms. They are manufactured largely in Berkshire County, Mass.

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RECENTLY PATENTED INVENTIONS.

Engineering.

AUTOMATIC SMOKE CONSUMER. — Gotthold Langer, Trenton, Mo. This invention provides a construction for admitting air through pipes and tubes above the fire to the fire boxes and furnaces of steam boilers, and shutting off the air automatically without the attention of the fireman or engineer, so as not to cool unnecessarily the interior of the furnace.

AIR BRAKE. — William H. Walker, Martinez, Ga. This invention covers an improvement in the class of brakes in which a reduction of pressure in the brake pipe results in the application of the brake, and provides a simple means for automatically effecting the desired reduction in certain instances, as if the track should spread, the truck mount the rail, etc.

ROTARY SNOW PLOW.—Edward Leslie, Orangeville, Canada. In this plow, which is an improvement on former patented inventions of the same inventor, the wheel has pockets with rigid walls and is open in front to admit the snow and open at the top for its exit, the plow being specially designed to quickly remove the snow from railroad tracks and throw it to a distance on either side.

Railway Appliances.

CAR COUPLING. — Francois P. Onzon, San Antonio, Texas. On the under side of the drawhead is mounted to turn a shaft on which are hooks, with their free ends adapted to swing in front of the drawhead to hold the link in position, with means for operating the shaft from either side of the car, the device being simple and durable, permitting the coupling of cars of different heights, and obviating the necessity of going between cars to couple and uncouple them.

METAL TIE.—Martin Hubbell, Mount Kisco, N. Y. This is a tie designed to indicate variations from the vertical alignment of the track, and afford means for connecting such deviations without removing the tie or loosening its parts, with means also for quick lateral adjustment of the rails, while affording an interlocking bearing surface to the lower face of the cross tie, whereby longitudinal and lateral displacement will be prevented.

CAR REPLACER.—James McGary, East Tawas, Mich. Detachable clips adapted to engage with the track rails, with locking cams or eccentrics, are used in connection with inclined replacing rails or bars, so that when applied the latter will form leaders to or above the main rails, and diverging downward and backward therefrom, to the proper position to accommodate the opposite side wheels of the derailed car or engine.

EXTENSION CAR STEP. — William W. Beebe, Malvern, Ark. This step is pivotally connected by links with the insides of the side rails of the fixed or main steps, notches being formed in the side rails of the extension step to engage the foot boards of the main or fixed step, making a device which can be readily brought into use, and can be folded upon the fixed step to protect the latter.

BRAKE BEAM. — Jacob W. Baker, Dover, N. J. This invention provides a novel construction for trussed brake beams, and means connected therewith for holding and securing the spring which relieves or holds back the brake shoe, the beam having an arched back bar doubled over upon itself at its ends and a front bar having its ends doubled over the folded ends of the arched bar, with fastenings clamping the doubled ends of both bars together.

Mechanical.

WRENCH.—Herman Scheatzka, Bothell, Washington. One end of this wrench is designed to turn square or oblong objects, and the other for pipes or circular rods, the invention being designed to improve the facility of adjusting the jaws to the size of the object to be turned and provide for increasing the grip in proportion to the amount of power required.

SAW MILL SET WORKS. — Evan T. Davies, Portland, Oregon. This invention provides devices designed to permit of quickly and accurately setting the head blocks on the saw mill carriage in order to saw the log into lumber of any desired thickness, while being simple and durable in construction and very effective and automatic in operation.

LATHING. — Albert Weigle, Horn-am-Bodensee, Switzerland. This is a lathing easily applied to walls and ceilings, and consists of a series of reeds of small diameter placed alongside each other and supported on a wire and a second series of larger reeds parallel with the other reeds and interlaced with the same by a wire, and also supported on wires fastened to the wood backing.

PULLEY BLOCK, — Calvin H. Weeks, Haverhill, Mass. This invention relates to pulley blocks in which anti-friction balls are employed, and provides a composite sheave wherein a series of balls are loosely retained in a manner designed to greatly reduce friction, while simplicity of construction and durability of the parts are also secured.

Agricultural.

HAY STACKER. — Laban and Thomas Soseman, Oskaloosa, Iowa. This is an improvement on a former patented invention of the same inventor, designed to simplify the construction and provide a convenient means for raising the mast or pole of the stacker from the completed stack, and prevent its falling back when elevated gradually in making the stack.

TOBACCO STICK. — Joseph O. Renner and Noah Bowers, Greeneville, Tenn. In this stick to facilitate drying and curing tobacco leaves, longitudinal sections are secured together, and the headed hooks or pins are passed outward through each section alternately, each section serving to secure the hooks or pins of the other section from displacement.

Miscellaneous.

APPARATUS FOR PURIFYING AIR. — Benjamin S. Benson, Baltimore, Md. A filtering case is arranged near the window of a room, in connection with a heating case and heating chamber connected with a combustion pipe, and other novel features, for purifying the atmosphere for respiration, the construction being more especially adapted for use in sick or sleeping rooms, and the invention presenting improvements on a former patented invention of the same inventor.

BLOW PIPE REGULATOR.—Eugene W. Presbrey, New York City. This is a compound device particularly designed for use in the illumination of stages in theaters, etc., and is adapted to maintain a uniform and continuous flow of the gases, thereby producing a constant temperature and even intensity of light, while preventing any mixture of the two gases, and providing means whereby the regulator tanks may be filled or emptied separately or together.

MINER'S LAMP.—John Ratz, Hazleton, Pa. This is a small and convenient lamp with a hook on one side by which it is attached to the head covering of miners, the construction being such as to prevent the lamp from leaking at its filler orifice, and obviate liability of entanglement and matting together of the cotton wicking, and also to prevent the lamp from rocking laterally.

PIPE COVERING. — John F. Tracey, New York City. These coverings are preferably made of asbestos in half sections, each having integral end parts adapted to fit a pipe, with an intermediate recessed or hollow body portion assuring an air space next the pipe, the end parts of the coverings having grooves or passages making the air space continuous along a line of pipes.

PHOTOGRAPHIC CAMERA. — George Shorkley, New York City. In this camera the swing back is held adjustably in the camera casing to move the dry plate or film in proper position with regard to the object to be photographed, the swing back being pivotally connected with the camera casing, and the invention being an improvement on a former patented invention of the same inventor.

GATE LATCH. — John A. Lindberg, Dayton, Iowa. Combined with a hook capable of lateral movement upon a gate standard is a keeper having outwardly extending spaced arms with slots therein, and a lock lever fulcrumed in the slots of the keeper, the device being more especially adapted for attachment to light gates.

SCIENTIFIC AMERICAN BUILDING EDITION.

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4. An attractive dwelling at Hollis, Long Island, erected at a cost of $6,000 complete. Perspective view and floor plans. Schwietzer & Diemer architects, New York.
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9. Perspective elevation and floor plans of a handsome cottage at South Orange, N. J. Charles B. Atwood, New York, architect. Cost $13,000 complete.
10. Engraving showing a block of economical brick houses erected at Philadelphia, Pa. Cost $2,000 each. J. M. Stiller, of Philadelphia, architect. Floor plans and perspective.
11. Perspective and floor plans of a Lake Side cottage at Minnetonka, Minn. Cost about $4,000. W. H. Dennis, architect, Minneapolis.
12. Miscellaneous contents: Some of the merits of the ARCHITECT AND BUILDERS EDITION of the SCIENTIFIC AMERICAN.—The air supply.—The Alhambra.—Decoration of entrance hall, illustrated.—Questions on construction.—The Henry Martin brick machine, illustrated. — Buckeye Portland cement. — A government contract for woodworking machinery.—Architects' and carpenters' transit, illustrated.—Improved dwelling houses, illustrated. — Dumb waiter and hand power elevators.—Improved double blind wiring machine, illustrated.—An improved boiler for power and heating, illustrated.—Resistance to fire of wood posts.—An improved door spring, illustrated.—An improved hot air furnace, illustrated.—The Taylor "old style" roofing tin.

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S. S. N.—Elizabeth, N. J.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2535) G. L. S. asks (1) how to mend an iron kettle, called porcelain-lined, a large one burnt off in the middle. A. This cannot be done. The new enamel would have to be of the same composition as the old, and any attempt would result in failure. 2. And would also like to have a receipt for a liquid stove polish. A. Mix 2 parts of copperas, 1 part of black lead, and 1 part of boneblack with water to give the consistency of cream. Keep in a tightly corked bottle. Apply with a brush.

(2536) L. J. O. asks: What are the proportions used in making a good emulsion of cod liver oil with phosphates of lime and soda, and what is the process of mixing them? A. Emulsion of cod liver oil with phosphates of lime and soda.

Cod liver oil	8 fl. oz.
Mucilage of Irish moss	5 " "
Phosphate of calcium	128 grs.
" sodium	128 "
Sirup of tolu	1 fl. oz.
Alcohol	1 " "

Flavoring sufficient quantity wintergreen and oil of bitter almonds.

Water q. s. to make	16 fl. oz.

Dissolve the phosphate of sodium in the mucilage of Irish moss, and emulsify the cod liver oil with the latter. Then triturate the phosphate of calcium with the sirup of tolu; add the mixture to the emulsion; afterward add the alcohol and flavoring, and finally enough water to make the 16 fl. oz. Mix the whole thoroughly together.

(2537) T. J. McF. asks how granite-ware is made and what is used to make it. A. It is made on a basis of sheet iron. The goods are pickled in sulphuric acid, washed, and are dipped into a mixture of water and finely ground enamel, and are allowed to dry. They are then snow white in appearance, with some slight spots of rust showing through the coating. They are fired for about five minutes. This melts the enamel and the rust spots develop the mottling. The enamel is a glass that has been melted and poured into water and ground. Several meltings are advantageous. It contains soda, lime, silica, fluorspar, etc. The successful formula is in the nature of a trade secret.

(2538) W. M. writes: I am making a modified Wimshurst induction machine. I would like to know whether the tubular and solid shafts are brass or wood? Would a hard wood ring do in place of the vulcanite ring? A. The tubular shafts may be made of wood, and the solid one of brass or steel. Hard wood may be used for the ring, provided it is well dried and soaked in paraffine. 2. I also made an induction coil. I used naked wire, and it gives only ¼ inch spark. Would No. 36 cotton-covered wire do, insulating each layer with the insulating cement mentioned in "Experimental Science"? A. Yes.

(2539) T. McA. asks (1) how to prevent soap from shrinking after it is cut into bars. A. By some of the additions prescribed below you may prevent it. One treatment is to allow the bars to shrink and warp, and when it is over to plane them straight. 2. What to put into soap to make it hard. A. Soap made with good fat and soda should be hard if too much water has not been used. It can be further hardened by having a limited quantity of a strong solution of sulphate or carbonate of soda crushed into the finished product after framing. About 5 per cent of the dry salts may be used dissolved in as little water as possible. Or 10 or 15 per cent of a 50° B. solution of silicate of soda may be added. 3. How to cut soap into three-quarter pound bars and stamp name into soap? A. Have the name in raised letters on the bottom of the frame. Cut with wires after setting. See Brandt's "Manufacture of Soap and Candles," $7.50, and Cristiani's "Technology of Soap and Candles," $7.50, you will find much useful information on such points.

(2540) H. A. M. writes: 1. Could you tell me of a compound that when it is first used is thin enough to press in a small hollow and that would get hard like sheet rubber and as flexible, and that would preserve the impression? I wish to take an impression off lumber and to keep grain marks. A. Try a mixture of glue 10 parts, glycerine 2 parts. Soak the glue in water, dissolve by heat and add the glycerine. Oil the surface to be copied before applying. 2. Could you tell me how I could get a lasting impression on unvulcanized sheet rubber, without making mould out of plaster of Paris? A. Press against the surface well coated with talc powder and heat and again press. The rubber must be vulcanized, or prepared for vulcanization. Nothing can be done with pure, unvulcanized gum. See our SUPPLEMENT, Nos. 249, 251, 252.

(2541) H. B. says: Will you kindly settle an argument that has arisen in one of the machine works in this place? All the men in the room save myself say that the gibs on a planer head do not hold it from dropping. One man says that he cannot do a fine job on a planer that has any lost motion in the screw, says that the head will drop and cause the tool to dig in. I say that I can take the rejected planer or any other and do any ordinary job in first class shape with the down feed screw taken out of the planer. A. We have done some very good work on a rickety planer, which does not waive our admiration for a perfect tool. What your shopmates say they cannot do may be true, and what you say you can do may be also as true. There is much in knowing how to do good work with poor tools.

(2542) L. W. K. asks: How can I take the rust out of a nice breech-loading shot gun? There is not very much in it, but coal oil will not do any good, and some others that I have tried. A. You cannot entirely remove the roughness caused by rust in the gun. Clean to an even surface with a wooden ramrod with a plug end that just fits the bore, using tripoli and oil on the plug.

(2543) G. C. S. writes: 1. I have two 12 inch board rubber triangles which were accidentally exposed to the rays of the sun for a few minutes and were considerably warped. How can I make the edges straight again and also preserve the right angles? I am not so particular about the other angles. A. Heat slightly and press into shape between two boards. You can ascertain the degree of heat needed by trial. Use a little at first and increase until the straightening is effected. Heat in warm water. 2. Can you recommend a good book on railroad surveying, for a beginner? I understand land surveying, also trigonometry, etc. A. We recommend Byrnes "Pocket Book for Railroad and Civil Engineers," price $1.75, which we can supply.

(2544) C. B. says: I would like to ask you if you can tell me the difference between high pressure engine and low pressure. A. A high pressure engine runs by the direct pressure of the steam only. In a low pressure engine the exhaust steam is condensed with water or otherwise and a vacuum formed in front of the piston, adding from 13 to 14 pounds per square inch to the power of the piston.

(2545) F. A. M. asks: How can I ascertain the length of the radius (without laying off) of the arc, the length of the chord and distance between the middle of arc and middle of chord being given? A. See query No. 2495, in SCIENTIFIC AMERICAN, October 11, 1890.

(2546) A. B.—The silver medal found in the prairie in Sioux County, Iowa, is one of those given by George III. to the Indians who assisted him in the

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revolutionary war. They are quite often found among the descendants of those Indians and are, as in this case, sometimes dug or plowed up. It is worth about $7.50.

(2547) **J. S. J. asks how to make the** bright red sealing wax. A. Melt at the lowest possible heat 4 ounces pale shellac in a bright copper vessel, when fluid mix in with it 1¼ ounce Venice turpentine warmed a little and next add 3 ounces of best vermilion. Mix thoroughly, using as little heat as possible. Some add a little alcohol to the shellac.

(2548) **B. W. S. asks: 1. Please give me** a formula for the lens in an amateur enlarging camera for Kodak negatives. Also the prices of the same. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 451. Manufacturers of photo. apparatus sell special enlarging cameras. Cost $25 to $30. 2. Give date or number of query in which the hydroquinone or eikonogen developer is described. A. See SUPPLEMENT, No. 621, for hydroquinone developer. For eikonogen, see SCIENTIFIC AMERICAN, September 21, 1889, and April 26, 1890. 3. Where can it be procured? A. Both can be obtained from photographic dealers in your vicinity. 4. What is the best lubricant for the commutator of an Edison machine? A. An occasional wiping with a cloth moistened slightly with oil is all that is necessary. 5. What is the best size of wire for the simple electric motor (Experimental Science) for 110 volts? A. Use No. 20.

(2549) *Determining the Radius of an Arc.*—In the Notes and Queries column, query 2495, of your issue of October 11, G. A. S. gives this rule for finding the radius of an arc when its chord and rise are given: "To four times the square of the rise add the square of the chord, and divide this sum by eight times the rise." This is correct enough, no doubt, as you say, but the quantities are needlessly large. Is not the following a simpler solution? Half the given chord is evidently the sine of half the arc. The "rise" is the versed sine of this arc, which subtracted from the radius is of course equal to the cosine. Now, by the "pons asinorum,"

$$\sin^2+\cos^2=\text{rad}^2 \quad \text{or}$$
$$\sin^2+(\text{rad}-\text{versin})^2=\text{rad}^2$$

Reducing this we obtain

$$\text{rad}=\frac{\sin^2+\text{versin}^2}{2\ \text{versin}}$$

I. e. To the square of one-half the chord add the square of the rise, and divide the sum by twice the rise.

REV. CLARENCE E. WOODMAN, Ph.D.

New York, N. Y.

(2550) **C. P. B. asks: Will you please** give the rule for ascertaining the amount of curvature for any given distance on the surface of standing water or other perfect level? How far can the light on the statue of Liberty be seen? How far ought it to be seen from the deck of a vessel 20 feet above the water, in clear weather? I have seen it positively stated that on the Irish Sea the red light on Holyhead pier and the two bright lights at the Poolbeg lighthouse are both distinctly visible at the same time from a point midway between them though they are sixty miles apart; will you give their respective heights, and also state if you know anything about the facts in the case? What is regarded as the most conclusive evidence of the sphericity of the earth? I understand that there is a society in England that denies that the earth is a sphere; indeed, I have even met one or two of their disciples in this country. They seem to be people of ordinary intelligence upon all other questions. They are full of so-called facts which are in conflict with the accepted idea of the shape of the earth. The statement about the two lights on the Irish Sea is from one of their publications. It is also claimed that the light on the statue of Liberty can be seen ninety miles. A. Rule for curvature of the earth: Divide the square of the distance in feet by the equatorial diameter of the earth in feet—41,852,124; or a more simple one for ordinary purposes: Two-thirds of square of distance in statute miles equals the curvature in feet. The horizon of the light on the statue of Liberty is about 22 miles, and should be seen from the deck of a ship at 26 miles. We have no data as to the heights of the Holyhead and Poolbeg lights. Each should be over 400 feet above the sea to be both seen at midway with ordinary refraction. Probably, if the height is less than 400 feet, they have only been seen under conditions of extraordinary refraction in the atmosphere. The curvature of the earth, or depression of the horizon in every direction, as seen from high mountain peaks in the ocean, and the changes in latitude of sun, moon, and stars, as seen from different parts of the earth, are conclusive evidence of the sphericity of the earth. The light on the statue of Liberty may have been seen from some mountain 90 miles distant under extraordinary refraction. We give the statements of the flat earth society a very wide margin of doubt.

(2551) **J. C. L. asks: 1. What would be** the pressure attained by compressing the air in a cylinder, 20 by 5 inches inside measurement, down to 15, 10 and 15 inches, beginning with the air nominal? A. You would have 7½ pounds, 15 pounds and 30 pounds pressure at the proportions stated. 2. Would 70 pounds pressure on a one inch pipe be sufficient to attain a pressure of 30 pounds on a three inch cylinder? A. If pressures are per square inch, the cylinder would have 7 by 70 or 490 pounds on the piston. 3. Would a machine operated by springs be considered a perpetual motion, the springs worked by power furnished by themselves? If so, what ought such an invention bring if for sale? A. We have very little faith in the fact of a perpetual motion being offered for sale. We wish to see the perpetual motion first.

(2552) **F. G. M. asks: What are the** conditions requiring a division in an original invention where it applies to one commodity and is the invention of one person? A. Where two or more devices that can be separately used are claimed in one patent, the Patent Office generally requires a division and the taking of separate patents. For example, if the invention relates to a vehicle, and one claim is made for the hub, another for the seat, another for the spring, in such cases division is required.

(2553) **W. W. asks: Will you kindly give** me directions, in Notes and Queries column of SCIENTIFIC AMERICAN, for measuring primary batteries? A. We refer you to works on electrical testing, such as Kempe's "Manual of Electric Testing," $5, or Kempe's "Electrical Engineer's Pocket Book," $2.

(2554) **G. R. asks how to silver a piece** of plate glass to make a mirror. A. Spread a piece of pure tin foil on a marble slab, pour mercury over it until it is quite deep, slide your perfectly clean glass over it, keeping the front edge below the level of the amalgam, press with a heavy book, and after a day stand on edge to drain for a couple of days.

(2555) **P. J. T. writes: 1. I have a large** mirror, and lately it became spotted all over; it looks muddy. I first thought it was on the front of the glass. It was, but I found out afterward it was on the back. Could you give me a receipt to fix it, and would it be possible for me to coat the back without sending it away to a factory, that is, if it needs it? A. We strongly advise you not to attempt to repair it. Send it to a factory if they will undertake it. Often such a trouble cannot be satisfactorily dealt with. 2. How is mercury applied? A. See preceding query. For silvering glass consult our SUPPLEMENT, Nos. 105, 121, and 206.

(2556) **T. W. H. asks: 1. How can** paraffine be hardened? A. It cannot be hardened. 2. What is heel ball made of? A. Melt together beeswax 1 pound and suet 4 ounces, stir in very finely powdered ivory black 4 ounces, and lamp black (sifted) 3 ounces, gum arabic and rock candy very finely powdered, of each 2 ounces. When thoroughly mixed, pour into mould.

(2557) **G. K. R. asks (1) for a formula** for a cement that will firmly weld two or more thicknesses of cotton cloth, interfering the least possible with its flexibility. A. Try 5 parts of glue softened in water and mixed with 1 part of glycerine and heated to solution. 2. Some solvent that will prevent common commercial rubber cement setting so quickly. A. Add more naphtha, of rather a high evaporating point.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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October 21, 1890,

AND EACH BEARING THAT DATE.

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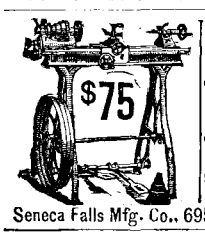

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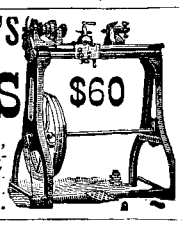

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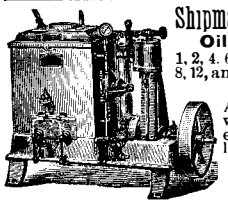

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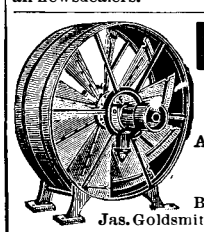

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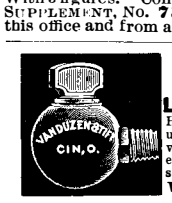

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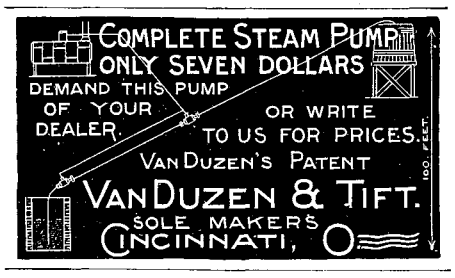

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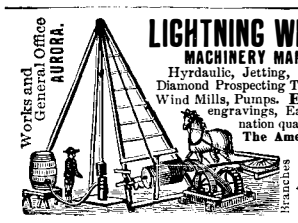

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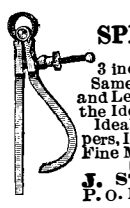

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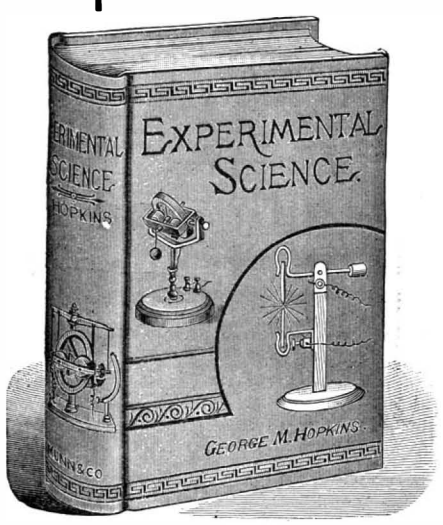

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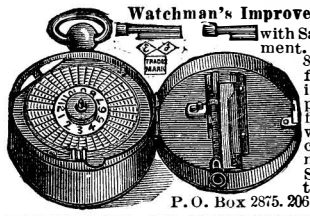

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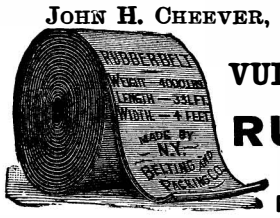

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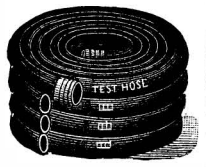

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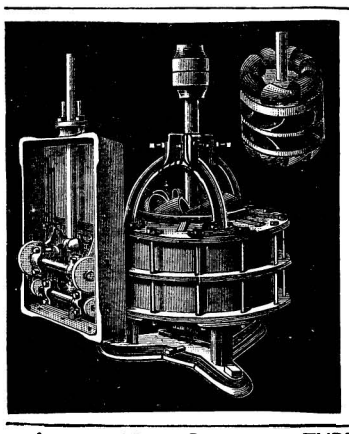

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U. S. Engineer Office, Room 62, Army Building, New York. October 15, 1890.—Sealed proposals, in triplicate, for dredging the channels in Newtown Creek, N. Y., Gowanus Bay, N. Y., and Raritan Bay, N. J., will be received at this office until 12 o'clock, noon, Friday, November 21, 1890. Aggregate amount available, $215,425. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol 24, page 414, Statutes at Large. For specifications, blank forms, and all information, apply to the undersigned.
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U. S. Engineer Office, Room 62, Army Building, New York. October 15, 1890.—Sealed proposals, in triplicate, for dredging Shell Reef, off Tenth Street, and for blasting and dredging Middle Ground, off Sunken Meadow, East River, N. Y., will be received at this office until 12 o'clock, noon, Wednesday, November 19, 1890. Amount available, $100,000. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For specifications, blank forms, and all information, apply to the undersigned. G. L. GILLESPIE, *Lieut. Col. of Engineers.*

U. S. Engineer Office, Room 62, Army Building, New York. October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until 12 o'clock, noon, Wednesday, November 26, 1890, for removing 560,000 cubic yards, more or less, of material, mud, earth, rock, old timber, etc., from the Harlem River, Spuyten Duyvil Creek, and from the cut through Dyckman's meadow, on the line of the Harlem River Improvement, and for furnishing the materials and workmanshi for the construction of revetments for slopes of the sections excavated. Amount available, $240,000. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For specifications, blank forms and all information, apply to the undersigned. G. L. GILLESPIE, *Lieut. Col. of Engineers.*

U. S. Engineer Office, Room 90, 134 Van Buren St., Chicago, Ill. October, 20, 1890.—Sealed proposals in triplicate will be received at this office until 12 o'clock, noon, Wednesday, November 19, 1890, and opened immediately thereafter in the presence of bidders, for the following harbor improvements, viz.: Dredging Calumet River, Illinois and Indiana. Dredging Calumet Harbor, Illinois. Proposals will be accompanied by a guarantee that if the bid be accepted, contract will be entered into within 10 days after notice of acceptance. The United States reserves the right to reject any or all bids. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For specifications, blank proposals, and all other information apply at above address to
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U. S. Engineer Office, Boston, Mass. October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for the delivery of 10,000 tons, more or less, of rubble stone at Newburyport Harbor, Mass. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for the delivery of 225,000 tons, more or less, of rubble stone, for the Harbor of Refuge, Sandy Bay, Cape Ann, Mass. Attention is invited to the Act of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. October 15, 1890.—Sealed proposals, in triplicate, will be received at this office, until noon of November 21, 1890, for dredging from Weymouth River, Mass., 25,000 cubic yards, more or loss, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 24, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 24, 1890, for dredging in Boston Harbor, Mass., 70,000 cubic yards of material, more or less. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large For full information apply to
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U. S. Engineer Office, Boston, Mass. October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 24, 1890, for dredging from the west end of Brewster Spit, Boston Harbor, Mass., 28,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. October 15, 1890.—Sealed proposals, in triplicate, will be received at this office until noon of November 21, 1890, for dredging from Winthrop Harbor, Mass., 18,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 21, 1890, for dredging from the channel leading to Nantasket Beach, Boston Harbor, Mass., 20,000 cubic yards, more or less, of material. Attention is invited to Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 21, 1890, for dredging from Salem Harbor, Mass., 45,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 22, 1890, for dredging from Gloucester Harbor, Mass., 40,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 21, 1890, for dredging from Hingham Harbor, Mass., 20.00 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 22, 1890, for dredging from Manchester Harbor, Mass., 20,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 22, 1890, for dredging from Scituate Harbor, Mass., 30,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 22, 1890, for dredging from Plymouth Harbor, Mass., 15,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
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U. S. Engineer Office, Boston, Mass. Oct. 15, 1890. Sealed proposals, in triplicate, will be received at this office until noon of Nov. 21, 1890, for dredging from Lynn Harbor, Mass., 40,000 cubic yards, more or less, of material. Attention is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For full information apply to
S. M. MANSFIELD, *Lieut. Col. of Engineers.*

U. S. Engineer Office, St. Augustine, Florida. October 15, 1890.—Sealed proposals, in triplicate, for furnishing materials and constructing jetties at the mouth of St. John's River, Florida, will be received at this office until 12 o'clock, noon, standard time, on November 15, 1890, and then be opened immediately. For all information apply to this office. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, p. 332, and Vol. 24, p. 414, Statutes at Large.
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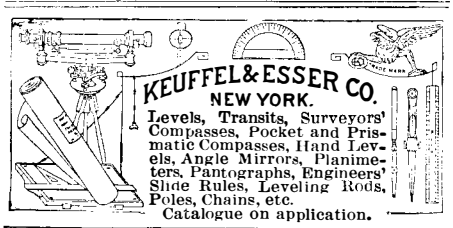

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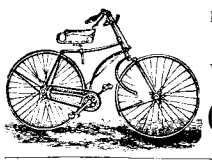

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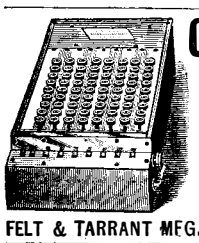

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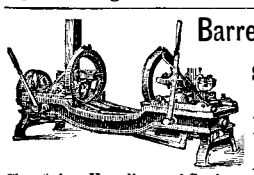

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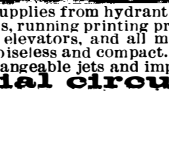

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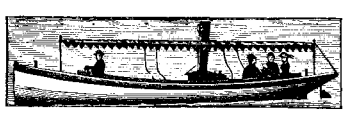

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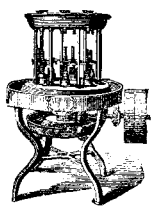

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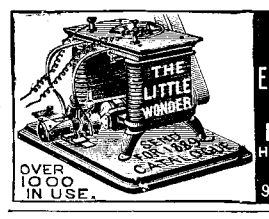

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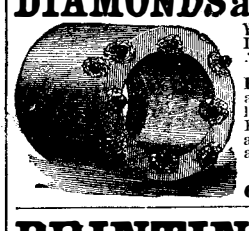

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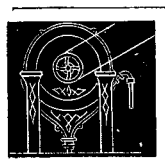

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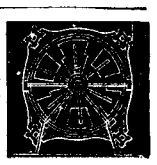

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